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MISCELLANEOUS AFFECTIONS OF THE KIDNEYS AND URINE

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ON

RENAL AND URINARY AFFECTIONS

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IN THREE PARTS

PART III.—MISCELLANEOUS AFFECTIONS OF THE KIDNEYS AND URINE

COLLEGE OF PHYSICIANS

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PREFACE.

In presenting this work to the public I have to apologise for its tardy completion. The delay has been partly caused by the demands of active professional work, and partly by my desire to incorporate the results of the experience thus acquired.

It was my design to follow the publication of *Albuminuria* with an account of the other renal and urinary diseases sufficient for the practitioner, and not too lengthy for the student. If I have, as I fear, erred in the direction of amplification, it has been from the desire to be clinical; not merely to give conclusions, but the grounds of them. I notice with regret as a substantial evil the bulk to which the book has swollen. Paper of some thickness was needed for the proper display of the woodcuts, and I have not thought it well to save space by contracting the type. I am assured that much of any interest which may be found will be in the clinical and pathological cases, but nevertheless it is possible that the value of some of them may not be thought commensurate with their weight. It was my intention to have presented the work in one volume, and the pages have been numbered continuously throughout in accordance with this design; but I have thought that the convenience of the reader would be best served by so far departing from the original plan as to issue each part in a separate cover, each with a separate table of contents, but with one index common to all.

I have not hesitated to fill up the deficiencies of my own observation with that of others; and where my opportunities have been small, as with regard to parasites, I have been content to present the existing state of knowledge little else than as a compilation.

I have considered in one place the structural alterations of the kidney, together with the results they produce; and in another the leading alterations of the urine, with the changes to which they are due. Many subjects have thus been shown from two points of view, and a certain amount of repetition entailed; but not otherwise could the mutual relations as well as the individual characteristics of the several disorders be presented.

With the existing abundance of works devoted to the purpose, I have not thought it necessary to give space to methods of urinary examination; nor have I attempted to deal at large with changes which the urine presents in connection with diseases external to the kidneys, and not manifested especially by their means; but I have regarded with a somewhat wide scope its more prominent morbid states, and the conditions which attend its absence and its superabundance. I have dealt fully with the circumstances of phosphatic excess, and of the additions of sugar, albumen, chyle, and blood. I have not given a separate chapter to purulent urine; since, so far as this can be considered apart from surgery, I judged that it had found sufficient mention under the headings of Pyelitis and Abscess. I have entered with some detail into the conditions of urine and of system which occur with the formation of calculi.

In preparing for the press the portion of the work which is now presented to the public, pains have been taken to make each subject level with the time; but even in the interval between printing and publication some cases have progressed in a manner I should have been glad to have recorded, and some researches have been made and opinions expressed which were excluded, not by choice, but by date. Cases in renal surgery have presented themselves which it was not possible to introduce, but the principles enunciated would not have been thereby altered. The chapter on disseminated suppuration has received some additional experience in the shape of a postscript, together with reference to some recent views on 'catheter fever.' The chapter in Part I. referring to the pathology of diabetes, which was published in the year 1877, has been re-written, which was rendered necessary by the discussions which it has provoked, and the further researches which it has instigated.

The publication of this work in portions has necessitated a mode of arrangement in which logical sequence has sometimes given way to convenience; but it is hoped that the disjointed parts will fall together without violence, and, with the help of the index, present a fairly accessible as well as a sufficiently inclusive account of the diseases of the kidneys, and the disorders mainly declared by their secretion.

9 Chesterfield Street, May Fair:
January 1885.

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MISCELLANEOUS AFFECTIONS

OF THE

KIDNEYS AND URINE.

CHAPTER I.

ABSCESS, OR CIRCUMSCRIBED INFLAMMATION OF THE KIDNEY.

It is scarcely necessary in these days to insist upon the obvious distinction between abscess originating within the renal substance, which is now in question, and suppuration of the renal cavity, or suppurative pyelitis, which will find mention elsewhere; although among the older writers the term 'abscess of the kidney' was applied indiscriminately to both, and much of their recorded experience thus rendered indefinite.

Suppurative or phlegmonous nephritis has its origin in the blood-vessels and intertubular tissues of the kidney, and is circumscribed to one or many points.

It may be produced by the following causes:—

1. Blows and mechanical injuries.
2. Irritant drugs.
3. Pyæmia.
4. Morbid states of the urine, such as are especially associated with cystitis.

5. The formation of tubercle and possibly other growths in the kidney.

For the latter conditions I must refer to the section upon tubercle.

Abscess of Kidney from External Violence.

Such immediate effects of external injuries as wounds, rents and bruises of the kidney do not come within the experience of the physician, and are not included in the present work.

Though it is not uncommon for the kidney to be broken or torn, life under such circumstances being endangered by hæmaturia and other immediate consequences of the accident, it would seem that there is but little risk of any induced inflammation of the renal substance. The rent is soldered up with coagulum, and if the patient outlive other results of the accident, effective union generally takes place, as in an instance related at p. 633.

Infrequency of traumatic abscess.

Suppurative inflammation in the substance or on the surface of the kidney, as the result of a blow or fall, is accordingly rare. Frequently as suppuration occurs in the kidney under other circumstances, traumatic abscess is a pathological curiosity.[1] One case and one only has been described at St. George's Hospital, as the result of an injury, and even that presented on *post-mortem* examination an equivocal resemblance to pyelitis. The pus escaped with the urine, and it is not clear that it had not originated in the pelvis rather than in the substance.

Examples of it.

The association of abscess with laceration or contusion of the renal substance is, however, distinctly seen in the following case which occurred in the practice of the late Dr. Bright. The preparation which is preserved at Guy's Hospital shows the result of a severe blow upon the loins, inflicted nine months before death. The capsule of the kidney, thickened in some places to half an inch, is separated from the surface of the gland by an irregular mass of mingled coagulum and pus.

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[1] This statement is not meant to include the caseous or tuberculous change which may follow a blow or fall and end in abscess or excavation. A description of this is to be found in Chap. X. of this part.

This is the only preparation I know of in the pathological museums of London which supplies an example of a renal abscess resulting from an external injury, though several cases could be brought together from other sources. The most frequent form appears to be the infiltration of part of the renal substances by pus and blood, possibly so as to convert it into a sanious pulp. Such an instance is related by Siebert.[1] A man jumped from a moving train, was turned over several times, thrown to a considerable distance, and found upon his back. The urine was afterwards scanty, bloody, and albuminous. After his death, which occurred in six weeks, the substance of both kidneys was found to be reduced to a pulpy, bloody mass, from which could be squeezed the detritus into which the greater part of both kidneys had been transformed.

The following case from Rayer appears also to be unequivocal:[2]—

Citizen A., aged thirty, was serving, in the month *Prairial*, on board a ship apparently in the Revolutionary service. He fell upon a yard so as to bruise the loins, especially over the region of the left kidney. This was followed by sharp and severe lumbar pain, which persisted in spite of frequent blood-letting. The urine became bloody. Febrile disturbance then set in, with which the urine, which had now ceased to contain blood, became scanty. The febrile symptoms gradually assumed a typhoid type, with dryness of the tongue and much prostration and shivering. On the twelfth day after the accident, the urine was temporarily suppressed, the secretion re-appearing on the day following with a large discharge of pus. The pain was now relieved, but the prostration continued, and he sank a fortnight after the fall.

After death a large quantity of bloody serum was found in the abdominal cavity. The left kidney was flabby externally, and was internally extensively broken up; it contained about an ounce of fœtid sanious pus.

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[1] Quoted by Ebstein, *Ziemssen's Cyclopædia*, vol. xv. p. 547.

[2] *Maladies des Reins*, t. i. p. 312.

Acute suppuration connected with the kidney appears to be generally attended with febrile symptoms, sometimes of a typhoid type; it is probable, however, that in this case the prostration was intensified by the blood-letting which was so remorselessly practised.

From the preceding cases we may learn that, though an event of great comparative infrequency, abscess of the kidney may result from a blow upon the loins or hypochondrium. Hæmaturia appears to be generally present at the outset, suggesting that the primary injury has been a laceration or contusion of the renal substance. According to the amount of contusion, the symptoms may take an acute form and rapidly destroy life with febrile prostration, or the abscess may, if I may accept the evidence of one somewhat equivocal case, become chronic, enter the pelvis, and continue for a long time to discharge, producing the constitutional effects of protracted suppuration. It is probable that in its less severe form the process may end in recovery.

Symptoms.

Results of contusion apart from abscess.

The kidney may be more or less bruised or contused by a blow, and quickly recover from the disturbance of function which has been so produced. In the following case there was evidence that an injury of the kidney produced a temporary condition of albuminuria.

A boy, ten years of age, came under my care at the Hospital for Sick Children. He had while at play fallen with his belly upon the upturned leg of a stool, and had made a bruise just in front of the left anterior superior spine of the ilium. Immediately after the fall he became sick and prostrate, and complained of abdominal pain. The next day, when brought to the hospital, he had signs of peritonitis, the belly was tympanitic and excessively tender, he lay, intolerant of movement, on the left side with the legs drawn up, the breathing was entirely thoracic, and was accompanied with catching pain. He had had diarrhœa, with much flatus, and liquid motions, which he said felt like boiling water, and there was much febrile disturbance. The urine was scanty, free from blood, but highly albuminous, the clot reaching to about a fourth. He had small repeated doses of opium, and warm applications externally, and in three days the acuteness of the symptoms had so far abated as to give promise of recovery. On the fifth day his progress was interrupted by an attack of acute pain accompanied by pleural friction in the lower region of the right chest, but this soon passed off, and he gradually recovered his health, the urine slowly approaching its natural abundance, the albumen steadily diminishing; though, when he left the hospital for the convalescent establishment, eighteen days after admission, a trace could still be detected by careful examination. He had lost all the other results of the accident.

The injury had evidently set up peritonitis, and had so bruised the left kidney as to occasion a temporary condition of nephritis. The attack of pleurisy on the right side, remote from the blow, was more doubtful in its source, and it remains uncertain whether it is to be accounted for by the direct effect of the blow, or whether it was produced indirectly as a consequence of the renal disturbance.

The following case is of interest, as bearing upon the remote consequences of renal injuries, though only indirectly connected with the subject of traumatic abscess.

Laceration of a kidney previously diseased, hæmaturia and collapse, apparent recovery. Death, after the lapse of eighteen months, from granular degeneration. Obstruction by coagulum of injured kidney.

A groom, thirty-five years of age, was brought into St. George's Hospital, having received a kick from a horse which broke his arm, and severely bruised the right hypochondrium. The accident was followed by extreme collapse, with the effusion of fluid, at first thought to be blood, but probably serum, the result of peritonitis, into the abdominal cavity. He had hæmaturia, at first copious, but which lasted for only two days. He lay for some time in extreme peril, but at the end of seven weeks he had so far recovered as to be able to leave the hospital.

Eighteen months after the accident he was recognised in a medical ward, where the case came under my notice as medical registrar.

It appeared that he had had his ordinary health from the time he went out until six weeks before his re-admission, when he became œdematous. It was learned, however, that for about two years (commencing apparently before the accident) he had been liable to pain in the loins, and that the urine had been increased in quantity and frequency.

On examination the urine proved to be pale, copious, albuminous to a third, to have a specific gravity of 1016, and to contain many coarse granular and some transparent casts. It was concluded from these circumstances, as well as from his worn, sallow aspect, that the kidneys were the subject of granular degeneration. He had much difficulty of breathing, coarse moist sounds being heard at the lower part of both lungs, and he sank a week after admission.

The *post-mortem* examination was made by Mr. Holmes, who has published the particulars in the 'Pathological Transactions' for 1859–60.

Both kidneys were small, granular, and full of cysts, giving evidence of a state of chronic disease which had evidently existed before the accident. The cellular tissue around the right kidney was much consolidated, and on making a section of the gland a large clot of blood was seen to occupy its pelvis and interior, communicating also with the exterior, where a considerable quantity lay in the sub-peritoneal cellular tissue. The line of rupture could be faintly traced through the substance of the gland. The ureter was completely impervious, being blocked up by coagulum. Numerous old adhesions united the right lobe of the liver to the diaphragm, probably marking the situation of the inflammation which caused the effusion of peritoneal fluid.

The lungs were much congested, their hinder and lower parts sinking in water. The heart was much hypertrophied, the valves natural.

In the extent of the laceration, which passed from the pelvis to the capsule, and its complete closure, the case is of interest as showing the great power of healing possessed by the kidney. The recovery from the rapid and total obstruction of the excreting channels of the one kidney is the more striking when we consider that the sole remaining kidney was probably at that time the subject of granular degeneration, on which account, as we may presume, it was incapable of the hypertrophy which occurs when increased duty is thrown upon a healthy kidney. The patient appears to have pursued his calling for a year, thinking himself well, though practically reduced to one kidney and that one diseased. When death occurred it was the result of the progressive disease in the uninjured kidney; had that been sound it is probable that the man would have been little the worse for the misadventure by which he was suddenly deprived of one-half of his renal structures.

Treatment of traumatic abscess.

The treatment of traumatic abscess of the kidney is negative: we have no encouragement to use any measures but rest and time, having regard to the constitutional state of the patient and his temporary symptoms. The kidney, as I have often seen, may be punctured with the aspirator without fear, but such abscess as results from injury is seldom definite enough to admit of relief by such means.

Irritant Drugs as Causes of Renal Abscess.

Cantharides.

Abscess of the kidney has been known to result from cantharides. The state of kidney usually produced by this irritant is one of acute tubal inflammation, and as such has been considered already (see p. 340); but it must be mentioned, in connection with abscess of the kidney, that it may possibly have this origin.

In the Museum of the College of Surgeons is a kidney which is almost completely destroyed by diffuse suppuration. Pus is extensively diffused through the cortex, and between it and the capsule; the surface of the kidney is covered with shreds of its own broken tissue, and the substance is excavated by a ragged abscess-cavity.

‘This was obtained from the body of a man sixty years of age, to whom tincture of cantharides had been given for incontinence of urine consequent on retention. The medicine produced extreme pain both of the bladder and kidneys, and retention, which lasted two days. When the urine was drawn off it was mixed with blood and pus, and fœtid. All power over the bladder was lost, and the patient, scarcely relieved of his sufferings, died in three weeks. The prostate was much enlarged. The mucous membrane of the urethra was covered with lymph; that of the bladder was sloughing.'[1]

Other examples are known of suppurative inflammation of the kidney from the same cause. Cantharides was formerly extensively given in cases of paralysis of the bladder connected with paraplegia, and opportunities of noting the characters of the consequent inflammation were of occasional occurrence. The pelvis and urinary membrane were affected very extensively, and in some cases covered with a membranous exudation.

Pyæmic Abscess.

Pyæmia more often calls for attention as a general condition than as affecting any organ in particular. The renal localisation, much as it may aggravate the condition of the patient, escapes notice during life amid the other disturbances of pyæmia so often that it is only in exceptional instances that it acquires clinical interest.

Coarse, morbid anatomy.

The morbid appearances characteristic of pyæmia as it affects the kidney are as follows: At the earliest stage at which the results can be detected by the naked eye, the kidneys, both of which are generally affected at the same time and in a similar manner, show on their surfaces and in their substance minute scattered patches of injected vessels. Later, each patch displays in its centre a white speck which is at first hard, but as it increases in size gradually liquefies, the softening beginning at the centre, until it is converted into a minute abscess surrounded by injected tissue. These abscesses are often plentifully scattered through the kidney, the cones usually containing more of them than the cortex. They are mostly of small size, seldom as large as a nut, generally comparable, when seen in circular outline, with peas, mustard-seeds, or small shot. They are usually, however, elongated, so as to present a circular outline only towards the surface of the organ. In the cones they stretch in the direction of the tubes and vessels of which the cone consists. Sometimes several can be seen in company, either distinct or more or less confluent, radiating through both medullary and cortical tissue, and impinging upon the surface, where the circular base of the abscess appears as a pustule underneath the capsule.

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[1] See Catalogue of the College of Surgeons.

On the surface of the organ the abscesses may be thickly or sparsely sown. They project from the surface like the eruption of small-pox, of which the surface of the kidney is under these circumstances often suggestive. Sometimes larger abscesses form bosses on the surface of considerable size and prominence. The surface of the gland around and between the points of suppuration is unnaturally injected, each pustule being sometimes surrounded by a bright zone of distended vessels.

The tissue of the organ is throughout more or less overloaded with blood, and often has the coarse texture and indistinctness of structure which results from epithelial accumulation.

Minute changes.

Analysing these obvious morbid appearances with the microscope, I have found them to consist of the following elementary changes.

The columnar and wedge-like disposition of the abscesses, as evident to the naked eye, is suggestive of their connection with blood-vessels, a connection which is at once evident on microscopic examination.

Many of the vessels of the kidney are occupied, often to distension, with a dirty white material, which appears to be morbid coagulum. This is sometimes seen in the larger arteries, but is found in the greatest abundance in the straight vessels of the cones, which are often swollen to varicosity. Less frequently the peculiar discolouration is found in the malpighian bodies and in the intertubular capillaries. Thus it would seem that the arteries have been injected with a material different from their natural contents, most of which is arrested in the small arterial branches, comparatively little reaching the vessels of the capillary size. It will be remembered that, according to the observations of Virchow, many of the straight arteries of the cones, which especially are the seat of the peculiar obstruction, come directly from the renal artery, some only being derived from the malpighian bodies. The contents of the arteries, therefore, early reach the cones.

The next step in the morbid process is the appearance among the obstructed vessels of rounded collections of pus corpuscles. These sometimes interrupt the course of a plugged vessel, as if formed at its expense; sometimes they appear among and between distended vessels, forcibly thrusting aside the vessels, tubes, and all the renal structures. These abscesses begin as small masses of coherent corpuscles, which often show in their centre small masses of the same matter as obstructs the vessels, suggesting their origin in the bursting of a vessel and the escape of part of its contents into the tissue to act as an irritant, and become a focus of suppuration.

The corpuscles rapidly multiply, and the abscess increases, pushing aside the tissue as it swells, until at last it assumes the character of a collection of liquid pus lying in a cavity bounded by condensed kidney-structure. Whatever the size of the pyæmic formations may be, whether invisible to the naked eye or as large as a marble, their anatomy is essentially the same. They are not made at the expense of the secreting structures, but are intrusions between them. They occur especially in connection with the straight vessels of the cones, upon which little globular collections are often ranged like beads upon a string. Where the vessels extend from the cones to the cortex the formations are apt to follow. Their situation is determined by the position of the distended vessels, and the only doubt which attends their origin is whether the vessel actually bursts, or without rupture permits the migration of its morbid contents through the wall. The microscopic appearances, as I have described them, are suggestive of rupture, the escaped morbid contents acting as the excitant of the cell-growth around, which eventually breaks down into liquid pus. These details are perhaps useful as bearing no less upon the general pathology of pyæmia than upon the particular affection of the kidney. They support the conclusions formed on different grounds by Mr. Henry Lee, and corroborated by other observers. Pyæmia is simply embolism in which the coagula distributed are morbidly irritating to the tissue, and tend by their contact to excite the production of pus. Whether their irritating quality is due to the presence of bacteria or to the admixture of any other morbid product, the process is clear in this as in other organs. Poisoned emboli, whether derived from a vein communicating with a wound or elsewhere, are let loose into the circulation, and finally distributed by the arteries, producing scattered abscesses such as have been described, in positions determined by the source of the infection and the course of the blood.

The clinical results of the renal implication of pyæmia are of only subordinate importance. Often as the kidney is found to be affected after death, it is comparatively seldom that this complication attracts notice during life. It may result from any of the causes to which pyæmia arising in connection with the systemic as distinguished from the portal vessels is due. In the cases I have referred to as the basis of this description the disorder was traced to the following causes: Diseases of bones and joints; osteomyelitis; periostitis; suppurating bursæ; senile gangrene; ulceration of cheek; diffuse suppuration after a bruise; amputation of limbs, and other surgical operations; and accidental wounds. In short, whatever be the source of a general pyæmic infection, the kidney runs its chance of attack, though affected far less frequently than the lungs, which from their anatomical relations are necessarily the first recipients of the poisoned current. Causes.

It does not consist with my present purpose to discuss

General symptoms. the general symptoms of pyæmia—these, the rigors, the febrile prostration, the altered colour of the skin, and the multiple abscesses, belong to the domain of surgery. The only signs of disease which point especially to the kidneys are shown by the urine, which is apt to become albuminous, scanty, dark in colour, possibly lithatic, and to abound with tube-casts of various kinds—epithelial, granular, and hyaline—while in some cases they characteristically imbed pus-corpuscles, while others, unattached, may be also discoverable with the microscope, though there is no bulky deposit of this nature. Casts are more regularly found with renal pyæmia, in which the urine is usually acid, than with the form of disseminated suppuration to be next described, in which the urine is almost constantly alkaline, and thus a solvent for these products.

Urine.

Though the pyæmic deposits are necessarily intertubal, the neighbouring tubes suffer by contact, as is easily seen by the abundance of plugged tubes around a pyæmic focus.

Perinephritic extension. Pyæmic suppuration, beginning within the kidney, may transgress its limits and become perinephritic, or even present itself as a superficial tumour. A woman had an abscess of the leg opened in St. George's Hospital; it closed, and she went her way, but shortly returned with signs of irritation about the place of the abscess, which was accordingly reopened. Then ensued rigors, sweating, and pneumonia, in addition to which a rounded swelling of the extent of the palm of the hand showed itself under the last rib on the right side. The urine was now highly albuminous, lithatic, and scanty. She fell into a condition of febrile prostration, with sordes on the lips and much dyspnœa, and thus died, seven weeks after the reopening of the abscess, three after the detection of the pneumonia. The external swelling was caused by a large collection of pus which lay between the liver and the right kidney, in the substance of which it had apparently taken its origin, lifting the capsule from the posterior surface of the organ. The abscess extended widely behind the peritoneum, in contact with the sacrum and ilium, both of which were healthy, and had penetrated for some distance down the psoas muscle in the course of the nerves. Both kidneys were occupied, particularly in their cones, with recent and caseating pyæmic abscesses.

There were extensive pyæmic formations in the lungs and heart. The source of the disease proved to be a sinus between the tibia and fibula, in which was found a strip of discoloured oiled silk four inches long, which had been lost in the abscess.

Treatment.

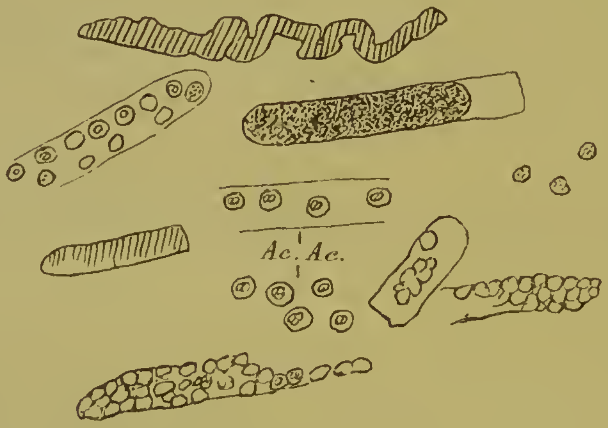
The treatment of renal pyæmia is not particular to the kidney, but general to the system, and therefore not within the scope of this work.

Renal pyæmia, with partial suppression of urine, and suppurative nephritis. Changes in the kidney as observed post mortem.

On October 1, 1870, I was asked by Mr. Rouse to see a man under his care in the hospital for hip-disease, who during the last three days had had bilious vomiting, loss of appetite, and feverishness, with alternate sensations of heat and cold. The hip-disease, which was of the left side, had lasted for about a year. There was no external opening; he was stated to have no disease of the spine, though he complained of numbness in the right leg. The pulse was rapid and feeble, the tongue dry, the complexion as yet natural. Next day (October 2), no urine having been passed for forty-eight hours, a catheter was used, and five ounces drawn off. This had a dark colour, like strong tea without milk, and an offensive smell, though it was acid in reaction. It gave an albuminous coagulum of about a fifth, and showed under the microscope a rich deposit of granular and hyaline casts and renal epithelium, both casts and epithelium being tinted brown. Next day (October 3) five ounces of urine were passed, which had the same characters in every respect; but on the 5th, the casts were found to contain pus-corpuscles, a character which by the 7th had become more marked, while loose pus-corpuscles had replaced the scattered renal epithelium. On the 8th, he shivered for the first time. This was followed by diarrhœa, frequent sweats, subsultus tendinum, yellowness of the skin and conjunctivæ, increasing rapidity of the pulse, extreme dryness of the tongue, so that articulation became difficult by reason of its stiffness, increasing prostration, and death on the 16th, without preceding loss of consciousness.

It was impossible to regard the disorder otherwise than as pyæmia with a renal localisation, a view which I was anxious to put to the test, and at last did so to a limited extent with the assistance of Dr. Cavafy, notwithstanding the removal of the body from the hospital to Brentford, and the presence, during the examination, of two draymen.

The abdominal cavity only was opened. The kidneys were enlarged to about double their natural size, full of liquid blood, and soft in texture. The capsules were slightly adherent, the surfaces nearly smooth, but unnatural in colour—of a deep reddish buff, as if from a mixture of vascular injection and tubal accumulation. On section, neither distinct abscesses nor plugged vessels were visible to the naked eye, though the outer edges of the cones were marked by lines of intense injection, in continuity with which ran yellow streaks up to the capsular surface. The cortex in section, as on surface, had a deep reddish buff colour, suggestive of tubal accumulation.



Casts; some containing Pus Corpuscles, in a case of Renal Pyæmia.

In section under the microscope it was found that many of the smaller arteries, especially those of about $\frac{1}{120}$ inch in diameter, were filled with pale coagulum, while a new corpuscular formation had collected in the peri-vascular interval. Many of the veins also contained clot. A few ill-defined cavities were also seen in the glandular tissue, in which nothing was to be made out but a ragged hole occupied by formless débris. Around these the tubular structure had a white appearance, as if infiltrated with purulent matter. Throughout the cortical and conical structure were numerous well-defined lengths of tube-plugs or casts, which were most thickly collected about the obstructed arteries. In all respects the condition was highly characteristic of pyæmia.

The bladder and ureters were natural.

Though the incompleteness of the *post-mortem* examination left the precise cause of the disease undefined, the case may yet have interest, as showing with sufficient clearness the symptoms of pyæmia when declared through the kidneys, as well as the changes there produced.

The Surgical Kidney; or the Kidney of Locally Disseminated Suppuration.[1]

General description.

The peculiar suppurative condition which is often spoken of as the *surgical kidney* is marked by abscesses scattered like those of pyæmia through the renal structure, but seldom involving other parts of the body. It has its origin in the presence of unhealthy urine in the bladder and absorption by the renal vessels. I ventured to propose the term *uriseptic* as descriptive of the invariable cause of this variety of renal suppuration, but possibly the term 'surgical kidney,' though it may throw blame with too little discrimination upon surgeons and their proceedings, may have become too well known to permit of any change in its designation.

Of all renal disorders, next to the varieties of albuminuria, this is the most destructive to life. It may almost be said to form the natural termination of stricture of the urethra, and is the especial danger which attends the use of the catheter and lithotrite. The attention which has been directed to this affection, however, is scarcely commensurate with its importance.

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[1] The publication of a considerable portion of the section on the surgical kidney was anticipated by its appearance as a paper in the *Medico-Chirurgical Transactions* for 1873, drawn forth by the interest which was directed upon the disease by the death from it of the Emperor Napoleon after lithotrity. The description now takes the place for which it was originally designed.

General morbid anatomy.

The change usually affects both kidneys, though in rare cases it is limited to one. The pelves are generally more or less dilated, and give evidence of inflammatory action in the state of their mucous membrane. This is commonly injected, often thickened, creamy, and suppurating, frequently encrusted with phosphatic salts, and not seldom partially or superficially sloughing. The kidney, if the primary obstruction be, as it generally is, of considerable standing, shows the results of wasting pressure and chronic vascular disturbance. The cortex is thinned, the capsule is thickened, and holds with unnatural tenacity both to the glandular surface and more closely still to the surrounding fat, which itself is often markedly increased, probably in consequence of undue vascular injection around the kidneys. Disseminate renal suppuration may, however, take place without any preceding chronic change, though inflammation or congestion of some part of the urinary mucous membrane, possibly of recent date, appears to be an invariable antecedent.

The glandular condition nearly resembles to the naked eye, and also, as will presently appear, in more minute respects, the renal manifestation of general pyæmia. The kidney becomes swollen and full of blood, much of which remains fluid after death, though some vessels contain clot evidently of *ante-mortem* origin. The tissue is variegated with blotches and streaks of intense injection; it is soft, friable, discoloured, and prone to decomposition.

The cones usually display to the scrutinising eye sharply defined white lines, which start from the tips of the mammillary processes in the pelvic cavity and pass into or through the cones in the direction of their striation. These streaks look like, what indeed they are, distended tubes, and are important witnesses of perverted action. Close to them swollen blood-vessels are often conspicuous.

Next, or possibly without such evidences of chronic change as the swollen tubes give, appear small, softly defined, fawn-coloured patches which streak the cortex from cones to capsule, or take the shape of wedges with the base against the capsule, the point entering the medullary tissue. These are at first scarcely less hard though more friable than the natural substance of the organ. They are surrounded and intermingled with vascularity. As the disease progresses they become large, irregular, and confluent, soften in their centres into ordinary liquid pus, and finally take the shape of scattered abscesses, varying from mere points up to the size of peas, or even larger. These are often thickly sprinkled through the gland, occupying the cones, where they keep more or less of a linear arrangement, and are less regularly but more numerously distributed through the cortex. They appear on the surface sometimes as purple blotches in which suppurative centres can be seen, or as discrete or confluent pustules, often nearly resembling a cutaneous pustular eruption.

With this condition the microscope shows more or less dilatation of the straight tubes, distension or morbid occupation of the associated blood-vessels, and disseminated intertubular suppuration, the distribution of which is regulated by the course of the veins.

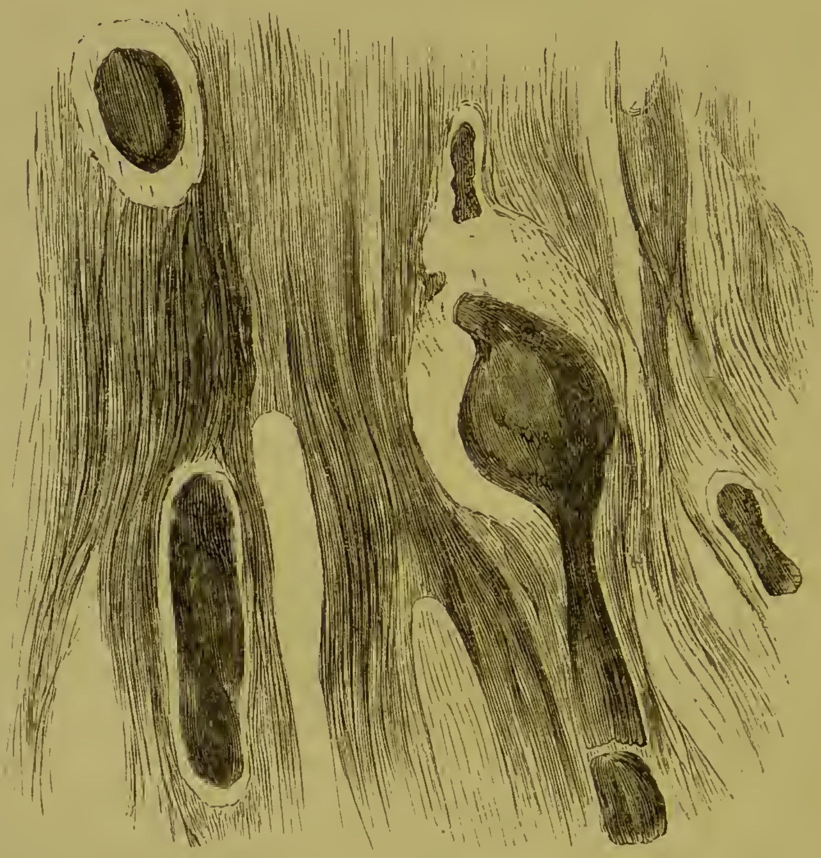
Straight tubes.

Passing to detail, and taking the straight tubes first as the parts of the organ first affected, these as they converge upon their outlets are often strikingly dilated apparently from the backward pressure of the retained urine. The dilatation is irregular, widening the cylindrical shape of the tubes or converting them into ovoid, globular, or shapeless cavities. They are variously occupied by saline matter, purulent secretion, fibrin, or epithelial growth. The straight tubes, thus stretched and filled, form the white lines which are evident to the naked eye. The change does not extend to the convoluted tubes, which remain for the most part natural.

Veins.

The veins, which appear to be next involved in the disease, are generally distended with blood. The straight veins of the cones often display in section a partial distension which is probably the result of coagulation which has occurred during life.

The larger veins of the cortex are often similarly filled, and it sometimes happens that the arteries which pass in companionship with them are likewise permanently occupied. As a general rule, however, the arteries are natural, as also are the Malpighian vessels.

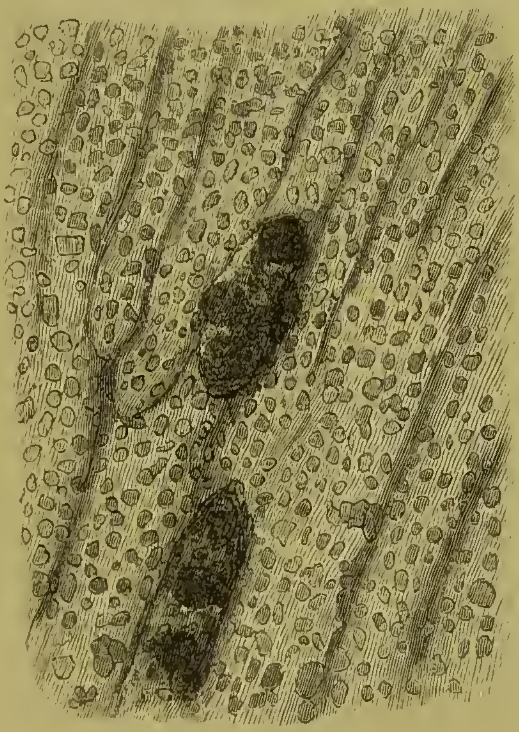


Straight tubes as they approach their exit dilated by backward pressure.

The venous position of the clot in the condition under consideration differs from the similar result of ordinary pyæmia, in that the obstruction there is essentially arterial.

Abscesses.

The third stage of the disease is the scattered suppuration which is the most obvious result of the complicated process. The disseminated abscesses, or regions of cellular infiltration antecedent to abscesses, are intertubular, and have relation to the course of the veins. Cells gather at isolated spots, sometimes obviously accumulated around a minute distended vessel. Occasionally the new formation overspreads considerable districts, insinuating itself more or less evenly between the tubes, its vascular origin being chiefly evinced by its obvious intertubular position. The Malpighian bodies remain unaffected by the disease, though the adventitious corpuscular formation often collects abundantly outside them. The convoluted tubes are generally clear, though where they cross the districts of infiltration their epithelium is sometimes superabundant, and sometimes they appear to be encroached upon, or confused by, the cellular formation around them. They are sometimes displaced or compressed.



Irritative plugs in small vessels surrounded by pus corpuscles—from cone.

Taking the structural changes in their mutual relation, the dilatation of the tubular exits, the morbid occupation of the veins, and the general absence of signs of tubal inflammation, the nature of the process is clear.

Process of production.

The disorder has its origin in the regurgitation of urine charged with morbific products. This, forced backwards by the retention general in these cases, distends or occupies the straight ducts. Thence by transudation, or similarly, it enters the neighbouring blood-vessels, and charges them with an infection resembling in its results that of pyæmia. This is distributed by the veins to the rest of the gland, sowing abscesses in their course, and ultimately causing constitutional symptoms analogous to those of pyæmia otherwise derived.

The condition of the kidney may be described as one of pyæmia arising within itself. It has a close general resemblance to that caused by a distant infection, differing from it in the usual dilatation of the urinary outlets, and in the fact that, while with pyæmia from a remote source the *materies morbi* is necessarily distributed by the arteries, in the condition under discussion it is scattered by the veins into which it was first received.

The disorder in its frequency and fatality has great practical importance. Inflammation of the bladder, or of the pelvis of the kidney, either as antecedent to the change, or associated with it, is so invariably present as to give a seeming warrant to the old view which regarded the disease as a mere extension by contiguity of inflammation beginning in the urinary cavities. The nature of the organic change, however, plainly declares its origin, not in the mere creeping of inflammation from membrane to gland, but in the absorption of morbific matter. Of this the urine is obviously either the source or the vehicle. It remains to inquire whence and in what circumstances the poison is engendered.

To help in answering these questions I have collected the particulars of sixty-nine cases of the disease from the *post-mortem* books of St. George's Hospital. The following table shows the urinary disease upon which the suppurative condition of kidney followed.

Causes in detail.

Disease antecedent to disseminated suppuration of kidney in sixty-nine cases.

Obstacle to escape of urine.	Stricture of urethra	19
	Disease of prostate, enlargement, tumour, or abscess	12
Loss of expulsive power.	Paralysis of bladder from fracture of spine .	5
	,, ,, disease ,, .	3
	,, ,, ,, of cord .	4
	,, ,, ,, of brain .	3
	,, ,, consequent upon exhaustion from disease or accident . . .	2
Vesical calculus.	Stone in bladder, no operation	6
	,, ,, lithotrity	6
	,, ,, lithotomy	3
Cystitis from other causes.	Cystitis from vesical growths, &c. . . .	3
	,, unexplained	1
	,, from discharge of lumbar abscess into bladder	1
Complicated.—Stone in kidney, with enlarged prostate . .		1
		69

I have next classified the descriptions of the urine in each case. The state of this secretion was noted in 47 of the number, in the following terms :—

State of the urine in forty-seven of the cases previously referred to.

Reaction stated.	Ammoniacal or fœtid, and mixed with various products of vesical inflammation . .	21
	Ammoniacal	1
	Alkaline and turbid, or containing mucus .	3
	Alkaline, bloody, and purulent . . .	1
	Alkaline or 'phosphatic'	3
Reaction not stated.	Ropy, containing mucus, pus, and blood .	1
	Containing mucus and pus	1
	Purulent and bloody	4
	Purulent	6
	Bloody	4
	Albuminous and turbid, or purulent . .	2
		47

Antecedent state of urine.

Looking first at the urine as directly connected with the origin of the disease, it appears that three conditions of this secretion usually concur—retention, ammoniacal decomposition, and admixture with the products of mucous inflammation. Of these an essential circumstance appears to be ammoniacal decomposition, which retention may induce, and cystitis either precede or follow. The urine was generally fœtid and more or less mixed with vesical products, pus, mucus, and blood. There is reason to believe that it was invariably ammoniacal. Wherever the reaction was stated it was persistently alkaline except in one instance. In this exceptional case the secretion was alkaline when the inception of the disease was declared by rigors, then for a short time acid, and alkaline again before death.

In the cases, comparatively few, in which the reaction was not stated, the condition of retention or the state of the urinary mucous membrane was generally such as to point unmistakably to ammoniacal change. The simple presence of pus or mucus in the urine, though lasting for years, does not appear to set up the renal disorder so long as the urine retains its acidity and resists putrefaction.

Apparently always ammoniacal.

I have myself known no instance in which the mischief has arisen except in connection with ammoniacal urine.

The ammoniacal change, however, though it may arise independently of mucous inflammation, produces it so constantly that the origin of the disease is always thus complicated. Sometimes, as with stone, the inflammation of the bladder has led to the change in the urine; sometimes, as in cases of paralysis, the change in the urine has caused the inflammation of the bladder. Whichever comes first, so long as the necessary foulness of the urine is attained, a condition which is promoted by the admixture of diseased vesical secretion, the renal suppuration may follow. Whether primary or secondary, the inflammation of the urinary mucous membrane is invariable. This is usually of the bladder, though the renal change has been known to follow inflammation and retention confined to the pelvis caused by a stone situate in that cavity.

Clinical antecedents.

Passing from the state of the urine to its clinical antecedents, these may generally be stated to be of three kinds—obstacles to the escape of the urine, loss of expulsive power, and vesical or, very rarely, pelvic irritation.

Stricture of the urethra is of all causes the most common, giving rise as it does to the needful urinary putrefaction, and in its chronic form ensuring the dilatation of the glandular exits which makes them ready recipients of the poison.

Enlargement of the prostate, scarcely less common as a cause of the disease, acts in the same way.

Next in order of frequency to such impediments come the diseases and injuries of the nervous system by which the expulsive power of the bladder is destroyed. These, giving rise to retention and decomposition of urine, and its contamination by the products of vesical inflammation, cause changes in the same sequence as those which arise from stricture, but more rapid in progress. The loss of vesical innervation in these cases hastens the disorganisation of the mucous membrane, which gives the extreme foulness to the urine observed in such circumstances, and sets up early and severe renal mischief. Similar symptoms may follow from cerebral disease, and occasionally from the general prostration which follows from disease or accident not directly connected with the nervous system.

Lastly, severe vesical irritation, though unconnected with retention, may cause the same results. The disorder was traced to stone in the bladder in fifteen of the sixty-nine cases previously referred to. Though differently begun, a similarly putrescent state of urine to that of retention is here in the end produced, contamination by mucous discharges which promote decomposition being apparently the incipient evil. Putrescence appears to be always present. In connection with the frequent origin of the renal suppuration from vesical stone its rarity as a consequence of stone in the kidney is worth remarking. The difference probably lies in the less putrefactive tendency of the discharges from the pelvic membrane or the less ready intrusion of septic agents.

It is frequently to be observed that the conditions of bladder and of urine apparently sufficient to produce the disease will exist for years without doing so, but that at once upon some surgical procedure, of which the use of a catheter is probably the essential part, it will start into activity as if the ready train were thus lighted. The term 'surgical kidney,' so generally used in reference to the disease, bears witness to its association with the use of instruments.

Probable agency of poisonous organisms.

Linking the secondary renal mischief with ammoniacal or putrid urine, and having regard to recent researches which have connected the lower kinds of organic life with pyæmia,[1] it is worth noting that the condition of urine which causes the disease now in question is one in which vibriones and bacteria abound; but considering the different circumstances in which such organisms appear it would be unsafe to draw more than a provisional inference as to the nature of the virus beyond the broad fact that it is associated with, and apparently dependent upon, decomposition of urine.

The frequency of the disease after the introduction of instruments may lead to a surmise which must have practical influence, that the essential virus is capable of being conveyed into the bladder by their means.

Since this conjecture as to the origin, or at least *an* origin, of the surgical kidney was made public, Dr. Ferrier has published some experiments which corroborate it. He found, as indeed had before been observed, that urine, if preserved from external contamination, might be kept without putrefaction for an indefinite time, but that the simple contact of a surface not freed from germs[2] was enough to initiate the putrefactive process. In this view the ammoniacal state itself is due to contamination from without. Whether this be so, or whether urine may become ammoniacal by causes acting only from within, as appears not improbable, it is none the less likely that the especial virus, of which the ammoniacal urine may be only the vehicle, may be introduced by such means. The practical suggestion as to the invariable carbolisation of catheters and bougies is too obvious to need insistance.

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[1] Dr. Sanderson, *Pathological Transactions*, vol. xxiii. p. 303.

[2] 'Septicæmia and the Catheter,' by Dr. Ferrier, *British Medical Journal*, April 1873.

General symptoms.

In connection with the pathology of the disease I may briefly sketch the symptoms, drawing chiefly from the cases to which I have already alluded. The disorder, particularly when the abscesses, as is too often the case, are widely disseminated, runs a rapid and fatal course. The patient generally dies within three weeks of the first symptom, sometimes within a few days. In fourteen cases in which the dates and symptoms were carefully recorded in the hospital books the duration of the complaint varied from two to eighteen days. As an example of its rapid course I may refer to an old woman who was brought in with a simple fracture of the thigh. Two days after the accident she became unable to pass water. A catheter was used, and the urine found to be natural. It then quickly became offensive and loaded with mucus, and death occurred within a week of the injury, three days after the urine changed its character. Small purulent deposits were scattered through both kidneys.

The course of the disease resembles that of pyæmia, differing from it in the usual exemption of other organs from the suppurative process. The symptoms are general rather than local; they point to contaminated blood rather than to disturbance of glandular function. Pain in the loins, however, sometimes occurs; and often the urine is much diminished, or even for a time nearly suppressed. Shivering happens early and is apt to be often repeated, and is sometimes as strongly declared as in the case of ague. Febrile symptoms rapidly follow, with typhoid prostration. The pulse becomes rapid and feeble, the tongue dry and brown, the appetite absent. Vomiting is a frequent and often an urgent symptom. Not seldom hiccough occurs, and sometimes diarrhœa or profuse sweating. The countenance becomes anxious and haggard, the complexion cadaverous or yellow, and possibly with low delirium, the patient sinks into utter prostration, unconsciousness, and death.

Erysipelas is an occasional complication, as also is a condition of pulmonary congestion or œdema short of that which results in pyæmic deposits.

Dropsy is uniformly absent, as in the case of pyæmia.

Not invariably fatal.

The disease is not always fatal. In examining the bodies of persons who have long suffered from disease of the urinary organs it occasionally happens that there are found upon the kidneys obvious scars, often much pigmented, in place and dimension such that they may fairly be attributed to ancient abscesses. Dr. Wilks tells me that he has made the same observation, and a case of the sort was related by Dr. Moxon in the twenty-third volume of the 'Pathological Transactions.'

Perinephritic abscess as a result.

As complicating the less rapid forms of the disorder must be mentioned perinephritic abscess from perforation of the capsule of the kidney and discharge into the areolar tissue.

In a body recently examined at St. George's Hospital a pint of pus lay outside the suppurating kidney; and preparations in the museum of St. Mary's Hospital illustrate a case in which a vast collection of pus reaching from the diaphragm to the groin, pushing forward the bowels and infiltrating the lumbar muscles, had the same origin.

By the courtesy of the medical staff I am enabled to give the particulars.

A man named Henry Sherwood, aged fifty-four, was admitted under Sir James Alderson. After having had stricture for many years and been the subject of continued catheterisation by himself and others, he found a tender swelling on either side of the umbilicus, which on the left side soon disappeared, but on the right it extended into the iliac and lumbar regions, reaching from the ribs to the crest of the ilium, where it gave evidence of fluctuation. With the increase of the swelling there was much constitutional disturbance, obstinate constipation, and an intercurrent attack of erysipelas of the face. He died, sensible to the last, eleven weeks after the first appearance of the swelling.

It was found that a collection of brownish blood-tinged pus, amounting to not less than forty ounces, lay behind the right kidney in connection with the surrounding fat, and reached from the diaphragm to the groin, pushing forwards the cæcum and colon, and infiltrating the lumbar muscles.

Another abscess, holding about ten ounces, lay immediately in front of the spine.

The right kidney was converted at its lower end into a mass of small abscesses, some of which projected from the surface, and one in particular had broken through the capsule into the surrounding loose tissue, and was in communication with the smaller abscess, which it had evidently originated. The larger abscess could not be traced to the kidney in the same direct manner, but there could be no doubt of its renal origin.

The left kidney contained a small abscess towards its lower end, which had penetrated the capsule, and was in communication with six or seven ounces of pus which lay outside.

The bladder was distended with clear urine, its coats were thickened, there was an old stricture of the urethra, and enlargement of the prostate.

The condition of urine to which the renal abscesses in this case were probably due had before death yielded to treatment. The chronic nature of the attack may be associated with the partiality of the renal suppuration; the greater part of each kidney had escaped. The case is remarkable, both in the cause and in the amount of the surrounding suppuration.[1]

Treatment.

The treatment of the established disease may be briefly described as that of pyæmia, upon which it is not needful to dwell. When the suppuration has taken a general hold of the renal structure there is probably little chance of recovery, though this may follow the slighter or more limited forms. The symptoms are mainly those of septicæmia, and our efforts called for to obviate death by the attendant febrile prostration.

Quinine and alcohol are largely needed, as well as special remedies to relieve special symptoms. The vomiting so often present may be controlled by ice and creasote, while active purgatives are often called for by obstinate constipation, and it appears that, especially when the urine is much reduced in quantity, the general state of the patient improves under their operation.

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[1] The right kidney is preserved at St. Mary's Hospital. The above particulars were obtained from the hospital records. The examination was made by the late Mr. Gascoyen.

It is sufficiently clear with regard to this disorder that our efforts must be directed rather to prevention than cure; and our knowledge of the conditions under which it arises is encouraging in this respect.

Prevention.

The frequent appearance of the disease after the use of instruments makes it imperative never to do so without antiseptic precautions. The association of the disease with vesical inflammation, and the admixture of its products with the urine, must furnish a warning to both surgeon and physician, which the latter may take as an indication, in cases of paralysis and prostration, to ensure the regular and complete emptying of the bladder. It is necessary to have regard to the conclusion that the disease is produced not simply by cystitis, but by septic changes consequent upon it, which are associated, as it seems invariably, with an ammoniacal state of urine. If therefore this can be prevented, so may be the disease.

Injections.

Next to the proper evacuating of the bladder, the greatest service in the prevention of ammoniacal decomposition may be rendered by acid injections into it, of which I have found one containing nitric acid and quinine—15 drops of dilute nitric acid, 10 grains of quinine, and 10 ounces of water—to give the best results. The bladder may be washed out with this daily or less often. Towards the same end acids may be given by the mouth. The mineral acids are more efficacious than benzoic or any of the ordinary vegetable acids, and of the mineral acids I have got more decided results from sulphuric than from the others. But perhaps nitric or nitro-hydrochloric are not greatly less effective in acidification, and may be preferable in other respects.

Use of mineral acids.

A boy, ten years of age, had paralysis of the bladder caused by the pressure of a malignant tumour upon the nerves in front of the sacrum. Notwithstanding the daily use of a catheter, the urine became ammoniacal, and was found to contain ropy mucus and pus. I now ordered, three times a day, a draught containing twelve minims of dilute sulphuric acid. The urine remaining unaltered by the remedy, I gradually increased the dose. When this amounted to a drachm the urine became acid. It was still ropy, and evolved ammonia on the addition of liquor potassæ. The secretion remained acid until the sulphuric was experimentally changed for citric acid. This was given three times a day, in doses beginning with ten grains and gradually increased up to half a drachm. Under this the urine, excepting two days on which it gave an acid reaction, was constantly alkaline and increasingly purulent.

Dilute hydrochloric acid in half-drachm doses was substituted for the citric acid without any apparent acidifying effect, and the same statement applies to dilute nitric acid in doses of forty-five minims. In short, the only remedy which had the effect of keeping the urine acid in this case was sulphuric acid.[1]

Postscriptum, November, 1884.

While this work was passing through the press I have had some further experience in this matter to which I may briefly refer —at the same time that the subject of 'urinary' or 'catheter' fever has been regarded by others from a new point of view.

Occasional recovery from uriseptic abscess:

There are two points which I could enforce did space suffice: the one is that the subjects of this disease will sometimes recover though it present a threatening and even hopeless aspect; the other is the obscurity of the symptoms whence it may be supposed that the patient has some other lesion, or possibly no lesion at all. I have learned that however unpromising such cases may be, the prognosis should leave a way of escape. We know that the marks of this mischief are sometimes found after death in persons who have recovered from it. And with regard to the allied condition, ordinary pyæmia, it may equally be said that, however large the mortality it is not necessarily fatal. I recently saw in consultation a gentleman advanced in years, whose official position made him the subject of many inquiries. He had had a severe attack of cystitis sequent upon the introduction of a catheter, as I was

Case.

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[1] A detailed account of this case is published in the twenty-first volume of the *Pathological Transactions*, p. 397.

told by some irregular practitioner. He had purulent and alkaline urine, remittent fever, rigors, and prostration, of pyæmic type and most unpromising appearance. A near relative endeavoured pertinaciously, but without success, to make me say that there was no possibility of recovery; I did not discern the reason of this until afterwards, when I learned that the patient had been placed in the hands of a homœopath, under whom, after becoming worse, and as was thought moribund, he eventually recovered. Though the nature of the disease with this patient had not been clearly recognised until I saw him, it did not admit of doubt; that it was purulent absorption may be taken as certain, and no source unconnected with the urinary organs could be suggested. I could mention another case equally the subject of difficulty for a time, in which the diagnosis was confirmed after death.

Case illustrating obscurity of uriseptic abscess.

Colonel W——, about sixty years of age, who had seen service in many parts of the world, became the subject of medical speculation in England. He was thought somewhat vaguely to have liver disease, or, more definitely, gall stones. As a further symptom he became unable to pass water, as was thought from 'paralysis of the bladder,' though he had no paralysis anywhere else; and needed the habitual use of a catheter. After some months of this he somewhat gradually broke down. He became sallow, not distinctly icteric, had habitual feverishness of the remittent type, not extreme, with irregular rigors and sweatings, and weakness which slowly increased to prostration, which was attended with slight delirium, a dry tongue, feeble pulse, and typhoid aspect. It was evident that he was going to die, though not evident of what. The favourite hypothesis was that he had abscess or some other disease of the liver—he had been much abroad, and had had dysentery. I now saw the patient with Dr. Latham, of Cambridge, who prepossessed me with so suggestive a history of urinary trouble and suppurative fever, that I went to the case almost with a foreknowledge of what I should find. There was no stricture, but no power of relieving the bladder without a catheter. The urine contained a large quantity of pus of vesical character, was ammoniacal, light coloured, and of low specific gravity. The region of the liver presented no indication by which an abscess could be localised, and I had no hesitation in concluding that the kidneys were the seat of suppuration, and that of the disseminated variety and of 'uriseptic' origin. Quinine and acids were given, and measures taken to ensure the perfect emptying of the bladder, but he rapidly sank, and died a day or two after my visit. Dr. Latham found the cortical parts of the kidneys to contain disseminated abscesses, which varied from the size of a pin's head to that of a small horse-bean. There was nothing wrong with the pelvis or ureter. The inner coat of the bladder was thickened and reticulated, the urethra natural; the source of obstruction and of the whole mischief was in the prostate, the middle lobe of which was enlarged and projected over the opening of the urethra, forming a sort of valve which closed it. The liver was healthy, or only a little indurated.

Sir Andrew Clark's views on catheter or urinary fever.

The subject which the preceding cases illustrate, that of renal suppuration dependent on a septic influence conveyed by the urine, has recently received fresh[1] interest from the notice which Sir Andrew Clark has given to what he terms *catheter fever*, an old disease with a new name. According to this observer the commencement of the habitual use of the catheter, or 'the entrance upon catheter life,' as he phrases it, 'occasionally gives rise to a pernicious fever, which, in the majority of instances, destroys life, and sometimes, without the intervention of any sensible structural change, is sufficient to account for death.' In brief there is a 'catheter fever' which kills without structural change. In support of this, Sir Andrew relates from his own experience two instances in which a febrile state, the same I cannot doubt as has here been described as uriseptic, followed upon bladder trouble and the catheter, in one of which there was no post-mortem, and in the other, though there was much bladder mischief, 'nothing was detected in the kidneys;' and quotes older writers by whom a similar fever had been observed, and in some cases no lesion found.

My want of surgical experience does not allow me to discuss the evanescent and harmless rigors which are frequent after the use of the catheter. These occur irrespectively of renal disease, and have been generally thought to be of nervous origin.[2] Sir Henry Thompson is of opinion that beside these nervous rigors there are others equally transient which are due to absorption of urine; and this appears to be likely enough if it be not merely the urine which is absorbed, but some active septic poison of which it is the vehicle. Sir Henry further describes a recurrent urinary fever in which these rigors present themselves again and again at irregular intervals, but eventually, after perhaps four or five attacks, cease to recur, and leave the patient convalescent. With these it is thought that the kidneys are generally implicated, though not made clear in what manner. The next step is to the fatal and persistent fever to which Sir A. Clark refers as neither distinctly uræmic nor distinctly pyæmic, as probably *beginning* at least in the nervous system, and as unattended with any adequate or visible organic change. On this point I may appeal to my own experience, some of which I have related, which has made me familiar with a continuous or remittent fever, which is generally, though not always, fatal, which corresponds clinically with Sir A. Clark's description, and pathologically with that to which I have given the name *uriseptic*, and which is attended with the scattered renal abscesses which I have dwelt upon in the preceding pages. I have myself seen no instance in which the condition has lasted and proved fatal and nothing been found. I have seen cases, though it seems presumptuous to draw the inference which would follow, where the suppurative condition has caused characteristic symptoms, and been clearly displayed with the microscope, though it was so sparingly and sparsely evident to the naked eye that it has narrowly escaped being overlooked. It may be suggested, as a possibility, that the special poison may be introduced by the kidneys, without these organs themselves displaying any, or more than a transient, change. If this be so, I can only say that it has not fallen within my experience.

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[1] Proceedings of Medical Society of London, Dec. 17, 1883.

[2] Same reference, p. 115.

In my view, therefore, the 'catheter fever'—limiting this term to severe and continued disease—is due to the influence of septic poison introduced by the urine in the manner, and with the special renal changes, which have been sufficiently described. It is not uræmic nor is it fully pyæmic, though between it and pyæmia there is but a slight, and even a temporary separation. The disease, as has been sufficiently shown, is most apt to ensue where the kidney and its tubes have been dilated by preceding obstruction, hence the significance of pale, poor urine as an antecedent; but it may come on with a previously healthy kidney. It may arise quite independently of the catheter. At the same time, there is reason to believe that the use of this instrument often supplies the starting point, probably by way of inoculation.

Perhaps the smaller degrees of the remittent or recurrent fever which follow the catheter are produced by smaller doses of the poison. This seems more likely than that a condition as persistent as even these smaller forms are said to be should be produced by a nervous impression.

CHAPTER II.

PYELITIS.

Pyelitis is inflammation of the membrane of the pelvis of the kidney; it should not be confused, as it often is, with the disseminated suppuration of the renal substance which may be associated with it or may occur independently. Pyelitis is chiefly known as a consequence of other diseases and the immediate cause of many of their symptoms. It is considered in connection with stone and tubercle, and referred to, perhaps sufficiently, as the result of malignant growths, parasites, and poisons of the type of cantharides.

Commonly secondary to other diseases and conditions.

As produced by retention of urine and the cystitis associated with it, pyelitis has a large importance, already accorded to it, as a frequent, but not necessary, intermediary between those conditions and the disseminated renal suppuration which they give rise to. It is further taken into question as the common first stage of perinephritic abscess, and is regarded as originating in so many different ways, and producing so large a variety of results, that little can be said separately concerning it which would not involve useless iteration.

The pelvis of the kidney is not quick to inflame, though under such irritants as have been mentioned it may do so somewhat intensely, and give issue to discharges so profuse and persistent as to cause death by exhaustion, with the intervention either of hectic or of lardaceous disease.

Local changes.

Under recent irritation the pelvis of the kidney may become highly injected, spotted with ecchymoses, and coated with soft, false membrane, which may have almost diphtheritic separability. I have seen a very distinct false membrane in this situation as the result of tinctura lyttæ medicinally given. The woodcut at p. 793 shows a well-marked separable membrane formed upon the pelvis as the result of tubercular disease; the membrane is seen to occupy the infundibulum, and had partially obstructed the ureter, as the consequent dilatation shows. This result, however, of pelvic inflammation is not one of the most common. As the condition becomes chronic it is usually marked by the white opacity which is so often associated with the production of pus, varied, if the disease be tubercular, with much roughening, ulceration, and thickening of the pelvis; it is not necessarily accompanied with dilatation, though the two conditions occur together far more often than either separately, owing to the frequency with which causes of pyelitis are causes also of obstruction to the pelvic exit. The forms and results of pelvic dilatation have been further referred to in connection with stone and perinephritic abscess.

False membrane.

Dilatation.

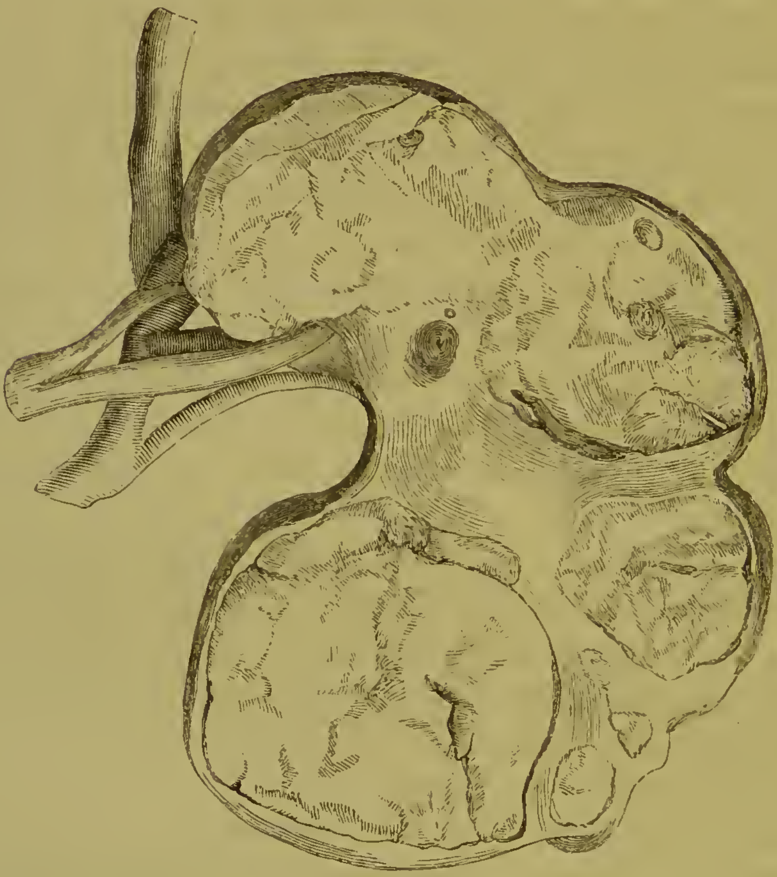
Occasionally the suppurating cavity will become closed, cease to stretch, and the secretion stop apparently because there is no room for more; that which there is becoming reduced by time and absorption to little more than its mineral residuum. The kidney may be converted by this process into a partitioned cyst, of which the walls consist of little more than fibrous tissue, and remain as harmless as useless. An example of this result, from the museum of St. Bartholomew's Hospital, is represented in the woodcut. Of the kidney little remains but a shell of fibrous tissue, which contains a substance like mortar, consisting chiefly of phosphate of lime, with a small admixture of carbonate of lime and animal matter. It was found in the body of a woman who died at the age of sixty-two, having for twelve years before had no sign of renal disease.

Obsolescence.

The septa of such cysts have become calcified, and true bone has been found in them, as in an instance recorded by Dr. Roberts.

Little remains to be said except to indicate one or two causes of pyelitis which do not find place elsewhere, and to refer to some results of it which may be attributed rather to itself than to the diseases with which it may be associated.

The lesser degrees of pyelitis, more often evident after death than during life, may ensue upon almost any change in the urine, more especially if it be alkaline. Advanced albuminuria and diabetes may be thus accompanied, though usually to an unimportant extent. With regard to chyluria, I have recently seen an instance in which this disease, contracted in India by a boy at the age of four, was found to have been succeeded at the age of seven by a profuse and constant discharge of pus, pre-



Kidney converted into bag of earthy matter, as the result of pyelitis.

Results from urinary changes.

sumably from the pelvis; the urine retained its acidity, and there was a total absence of bladder symptoms. This discharge continued under observation for a year and a half; I then lost sight of the child for three years, at the end of which time the urine was natural and the child well. Whether in connection with urinary change or the extension of vesical inflammation, pyelitis often takes place in connection with stricture, stone in the bladder, and paralysis, together with the disseminated suppuration which has been considered elsewhere. And often when this graver complication has not been induced pyelitis alone, or accompanied only with inflammation of the bladder, may ensue from the same causes, any, to wit, which involve retention and decomposition of urine—diseases and injuries of the nervous system, typhus, and all other states attended with inaction of the bladder, whether from paralysis or prostration.

When thus uncomplicated, this disease is transient, if the cause is so, and has little clinical importance.

It may be observed in passing that pyelitis, unattended with disseminated suppuration, does not give rise to the signs of septic absorption, resembling those of pyæmia, which belong to the latter disease, though it may produce results, as will presently be seen, allied, though dissimilar. The failure to mark the distinction between the two conditions has caused much confusion.

Apart from urinary changes, gout, gonorrhœa, and apparently pregnancy, have definite place as causes of pyelitis. With gout and gonorrhœa the inflammation creeps from the bladder up one or both ureters—if both, often successively rather than simultaneously—and so reaches the cavity of the kidney. Gouty inflammation of the bladder, with its distressing frequency and sometimes intolerable pain, the urine first highly acid and then purulent, is a phase of the constitutional disease which has received little notice, though sufficiently striking. It would seem that the pelvis of the kidney may be similarly affected in sequence to it. I saw, with Dr. Baber,

From gout.

a lady between sixty and seventy years of age, the member of a gouty family, though never herself the subject of gout in any ordinary form. After exposure to the severe cold of January 1881, together with the mental shock attendant upon the partial destruction of her house by the explosion of a boiler, she had severe cystitis, constant vesical pain, incessant micturition, and the passing of highly acid scanty urine, loaded with lithates and containing pus. After about a fortnight the pain and tenderness passed up the course of the left ureter, and became fixed in the position of the left kidney; a week or two later precisely the same process took place with regard to the right ureter and kidney. It was next found that the pain in the right side was enhanced when the patient turned upon her face, a tumour at the same time falling forwards from the loin, possibly a kidney dilated as the result of pyelitis. She had never passed stone or gravel.

From gonorrhœa.

I have more than once recognised a similar ascending inflammation as the result of gonorrhœa, cystitis being succeeded by pain along the ureters, and that by pain of a more lasting character, together with deep tenderness in the position of both kidneys, the urine containing pus but giving no evidence of disease of the renal substance.

Of puerperal origin.

A form of renal colic, preceded by chill and fever, and regarded as pyelitis, has been described as occurring in the puerperal state. The urine is said to be albuminous, and to contain such epithelium as the pelvis affords. I have known severe renal colic at the close of pregnancy to be succeeded and explained by the abundant escape of gravel. The pyelitis of pregnancy, if there be any, apart from such irritation has nothing in common with the suppurative extension known to occur after delivery, and produce perinephritic abscess.

The general symptoms of pyelitis, independently of those of the disease, whatever it be, which has given rise to it, may be briefly indicated.

General symptoms.

Pain may travel up the ureters, as in the cases referred to, and become fixed in the lumbar regions, as dull or weighty; but in many instances and for long periods there is no pain at all, or only what must be attributed to the disease in which the pyelitis has arisen. If the exit is free there will be no such tumour as can be appreciated from without, except, as sometimes in the case of tubercle, the original disease be attended with this degree of tumefaction. If the ureter be closed the swelling may be felt from before and behind, more often as a small than as a large renal tumour. Such are detailed too fully elsewhere to need description here. There may be at the beginning a discharge of mucus or of blood, and the latter may be repeated at intervals throughout the course of the disease, particularly if associated with stone, and sometimes if with tubercle. More characteristic is the persistent, or persistently recurring, discharge of pus with the urine, together with evidence that it is derived from the pelvis, or, what may be equivalent, that it is not derived from the bladder. If the exit is unimpeded the pus is 'laudable' and inoffensive; on standing, it separates somewhat abruptly from the urine, which retains its acidity. It has been stated so frequently that a discharge from the pelvis of the kidney can be distinguished by the epithelial cells which are shed with it that I almost hesitate to assert, what I have taken some trouble to ascertain, that there are no characters by which detached cells of pelvic epithelium can be positively recognised, however practicable it might be to distinguish the pelvic membrane could it be seen in mass.

Changes in urine.

Pelvic epithelium not distinguishable.

Roberts describes the epithelium shed as the result of pyelitis as being 'very irregular, spindle-shaped, tailed, three-cornered, elongated, rudely circular, etc.,' and as thus affording certain evidence of its origin. It will be seen, however, that these varieties of form, even to the '*etc.*,' are equally characteristic of vesical disease. Ebstein in 'Ziemssen's Cyclopædia,' describes the pelvic epithelium as characteristic in virtue of its shapes—'flattened, laminated, and caudate'—terms equally applicable, as the annexed woodcut will show, to epithelium derived from other parts of the urinary tract.[1]

Urine, though acid, may be fœtid,

and contain crystals of triple phosphate.

Often, as the result of pyelitis, the urine may be fœtid from the presence of putrescent purulent matter and still be acid. The alkalinity of the discharge from the diseased kidney is overpowered by the acidity of the normal urine from the healthy one. Had the decomposition taken place in the bladder it would have affected all the urine alike and made it ammoniacal throughout had it proceeded to any extent. Another indication of pyelitis which admits of a similar explanation is the presence in acid urine of triple phosphate crystals, which in these circumstances often show signs of superficial solution, from their exposure to acid urine after their formation necessarily in alkaline. The urine

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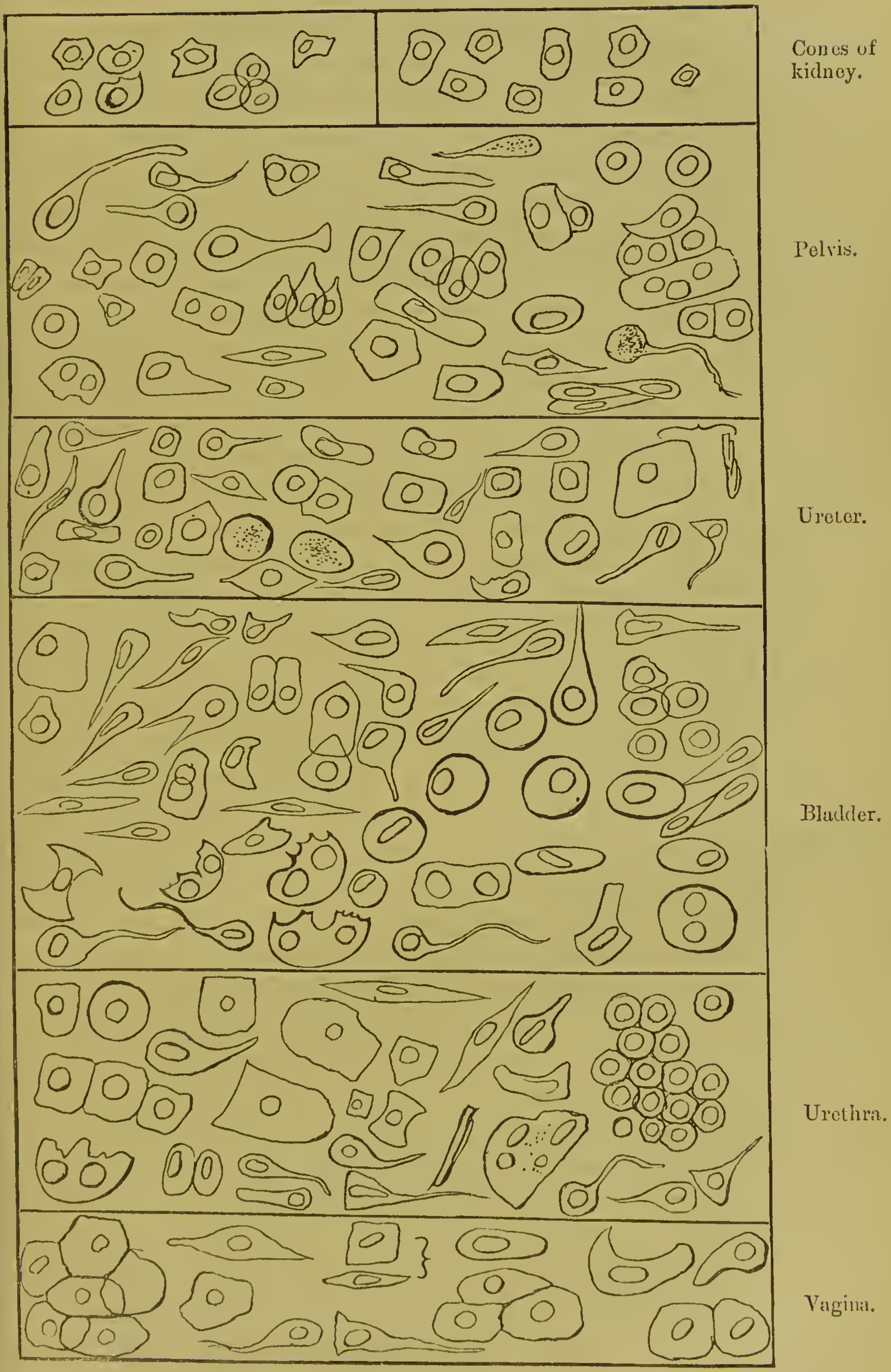
[1] In view of the localisation of disease by the urinary deposit, it is necessary to ascertain how far the epithelium from each part of the tract can be distinguished. The accompanying woodcut shows the varieties of cells which were obtained from each part of the urinary course in a succession of individuals not the subjects of urinary disease. The results are not valueless, but perhaps disappointing; they amount to this: The solid polygonal figures of the renal epithelium, of small and uniform size, can be easily recognised; diseases in which they are abundantly shed are commonly evident enough without them. Between the pelvis and the ureter no distinction can be made with certainty; both abound with club-shaped and tailed cells, and yield also others variously squared, rounded, and flattened, but none which are distinctive of either situation. In the bladder are abundant club-shaped fusiform and rhomboidal cells, not to be distinguished from those which belong to the pelvis and ureter, and others which are more significant, though perhaps none which are absolutely limited to this organ. The most characteristic cells are large and numerously scooped for adaptation with smaller cells below; these are not often to be recognised in morbid discharges, but must be accepted as valuable indications when they are. Besides these are other cells, the like of which are to be found in other situations, but when large, well marked, and numerous, may be generally reckoned as vesical. These are large, rolling globes or spheroids, with a well-marked outline and usually a single nucleus. The urethra may yield cells of many sorts, some globular and coherent, probably of glandular origin, others flattened, spindle-shaped, and of solid polygonal shapes. When many strongly marked squamous cells are to be seen, particularly if they are imbricated, they may be attributed to the vagina. It is to be noted that some of the vaginal cells in the woodcut were obtained from the bodies of children, and are smaller and less strongly marked than at more advanced ages.



Varieties of Epithelium from Urinary Tract in Health. ×220.

of pyelitis is often peculiarly disgusting, redolent rather of sulphuretted hydrogen than ammonia, or distinctly of both. The urine of bladder disease is more simply ammoniacal.

The discharge thus fœtid is apt to intermit completely or partially, being retained and decomposing in the cavity. When it appears it may present to the microscope a mere shapeless débris, from which all corpuscular shape has disappeared. The collection and decomposition of the urine in the pelvis is sometimes attended with signs of blood-poisoning, different, however, from those which proceed from disseminated suppuration. With the latter the symptoms have a pyæmic type, with fever at best remittent, and often with a jaundiced skin. With pyelitis there are fever and eruption, but, as far as I have seen, no jaundiced or pyæmic tint. The fever and eruption are both transient, the fever often without eruption, but the eruption seldom without some degree of fever. Febrile attacks with a temperature up perhaps to 104° may come on, last for a longer or shorter time, and then pass away completely. These are usually without organic change, but sometimes associated with a degree of pneumonia. The eruption which presents itself, though by no means regularly, as the result of pyelitis is usually to be classed as erythema, at least it consists of little more than injection of the skin, without the separation of serum or pus. This may occur in vivid spots or blotches, the latter often confluent. They occur mostly on the face, but occasionally on the trunk. The eruption may somewhat resemble that of measles, or more often of what is called German measles. It sometimes presents itself as herpes, the blotches being succeeded by the characteristic vesicles.

Signs of blood-poisoning.

Fever.

Eruption.

The course and duration of pyelitis vary as widely as its causes, and cannot be considered but in connection with them. When from stone, the disorder is indefinite in length, and may intermit completely for considerable spaces. When from tubercle, it is more brief; the discharge is constantly present while it lasts; if it ceases the

Course various,

cessation is final. Among the results of the disease the lardaceous change takes a prominent position, though death may be brought about independently of it by fever and hectic, or may ensue upon rupture into the peritoneum, into the bowel, or externally in modes which are considered in relation to stone, tubercle, and perinephritic abscess. Uræmia is not a consequence of pyelitis, though it may ensue from many of the disorders, obstructive or destructive, with which pyelitis may be associated.

as also are results.

To show the chronicity or tolerance of the disease, I may refer to a young lady now (1882) fifteen years of age, and in fair general health, who has been under my care with it for eleven years. The cause is probably stone. The urine is never quite free from discharge, the quantity and fœtor of which are exasperated at irregular intervals. There have been occasional attacks of fever and eruption such as have been described, and the character of the dislodged epithelium was such at least as to exclude a vesical origin. That it was not from the vagina was not equally certain. Occasionally, particularly after increased exercise, the urine displaced translucent flakes like bran or very minute fragments of silver paper. These consisted of masses of flat epithelial scales, placed with some regularity, and crossed here and there with lines of fibrous tissue. This patient apparently owed her endurance of the disease to quinine, mineral acid, and frequent change from London to the country or seaside.

Treatment

The treatment of pyelitis resolves itself into the treatment of stone, tubercle, and gout, together with the correction of alkalinity and fœtor in the urine, and the compensation of exhausting discharge. No process of counter-irritation has found support by my experience; indeed the disorder is, as a rule, too deep to be benefited by any local treatment. Where the urine has been persistently or occasionally alkaline, or even where it has been only reduced in acidity, I have found the greatest use in nitro-muriatic acid, together with quinine and other tonics.

Mineral acids.

Where it is fœtid, and a source of mischief by its retention and absorption, I have thought decided benefit to ensue from the administration of creasote. It is more easy to recognise the effect of this antiseptic upon fœtid discharges of many kinds than to explain the transmission of it as such to the place in question. When the discharge is chronic and exhausting, much may be done by liberal diet, quinine, iron, and change of air, especially to such seaside places as are reputed 'bracing.' Where pyelitis is conjoined with obstruction of the outlet and has led to so much accumulation of pus as to cause bulging in the loin, the question of puncture or incision from that surface may be entertained; but I think it is generally safest to wait until the matter has worked through its renal investment and presented in the back, and even then until it is nearly subcutaneous rather than to seek for it deeply. The consideration of this question belongs to the subject of perinephritic abscess.

Creasote.

CHAPTER III.

SUPPURATIVE PERINEPHRITIS.

If the terms perinephritis and perinephritic abscess were confined, as in strictness they might be, to abscess or inflammation beginning in and essentially belonging to the renal circumference, there would be little to add to what is to be found under several headings of renal abscess, stone, and tubercle. But though in the large majority of cases suppuration on the outside of the kidney is directly produced by suppuration within it, yet there are enough cases in which this is not so to make it necessary to refer to perinephritis independently as well as in its relation to renal disease.

Relations of matter external to kidney.

Irrespectively of its origin, pus, issuing from the kidney or formed in contact with its surface, commonly remains behind the peritoneum, burrowing among the deep muscles and fasciæ of the lumbar, pelvic, and crural regions. An abscess of extra-renal origin more often begins behind the kidney than in front of it, and thus has this organ between itself and the serous cavity: the same will of course happen should a renal abscess open posteriorly. If it break anteriorly it may, as in a case related in Chapter XIII., penetrate the peritoneum directly and set up fatal peritonitis; but even when thus escaping from the front this result is not inevitable, for the matter may either lift up the peritoneum and spread laterally behind it, or in perforating it may become so circumscribed by adhesions that the abscess is as good as post-peritoneal, though not actually so.

The capsule of the kidney itself often displays a remarkable power of confining matter within it. There is a preparation at the College of Surgeons in which at least half a pint of matter had collected between the capsule and the gland, which retain but few points of contact.

Its extension,

The fat and cellular tissue around the kidney are in close apposition with the muscles of the back, and not separated from the origin of the psoas muscle, the structures behind the iliac fascia, the sacro-sciatic foramen, or the course of the great vessels from the trunk to the thigh. Pus will easily traverse areolar and muscular tissues, but penetrates fasciæ and membranes with difficulty. It thus readily crosses the lumbar region, or, taking advantage of natural channels, passes down the psoas muscle to the inguinal region, or with the blood-vessels to the front of the thigh, or through the sacro-sciatic foramen, to appear upon the gluteal surface.

as psoas abscess,

The passage of such matter down the psoas muscle is of interest in relation to diagnosis. It is usually accompanied with flexion of the thigh, a symptom which may therefore be produced by disease of renal origin as well as by disease of the spine. I published a case many years ago in the 'Pathological Transactions,'[1] in which a psoas abscess had taken its origin in tubercular disease of the kidney, and have since known the same result to ensue from suppuration arising in stone.[2]

into the bronchi

Another mode of exit which is comparatively frequent is by the bronchial tubes. Matter of renal as of hepatic origin often passes upwards. It enters the muscular laminæ of the back and readily spreads between them, thus passing behind the diaphragm into the root of one of the lungs, commonly evading the pleura and penetrating the lower part of the lung directly. By this means localised pneumonia has been set up, and not infrequently the pus has found its way into one of the bronchi and so been coughed up.

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[1] *Pathological Transactions*, vol. xvi. 1865, p. 175.

[2] See Chapter XIII. As touching the relationship between urinary and psoas disease, I may mention that there is a preparation at King's College in which there has been a reversal of the process here described. An ordinary psoas abscess has discharged itself into the ureter, the matter from this source thus escaping by the urinary channels. So far the symptoms of renal were produced by psoas abscess.

and elsewhere.

It has been known also to be discharged by ulceration into the vagina, into the bladder, and through the prostate into the urethra.[1] The greatest variety of exit is presented by abscesses of calculous origin. These have been known, as detailed elsewhere, to discharge themselves superficially upon the loin, the gluteal region, the groin, the thigh, to enter the peritoneal cavity, the ascending transverse and descending colon, the duodenum, the stomach, and the bronchial tubes.

Discharge superficially.

The commonest issue is upon the back, where a wide brawny, doughy, or boggy surface, possibly erysipelatous or phlegmonous, presents itself between the last rib and the crest of the ilium. The hands before and behind the renal position may distinctly appreciate a fulness in it which will not move with respiration, as it might were it connected with the liver or spleen. It is upon the loin that incisions are most often called for, and from it that calculi more often make their exit than from any other part of the cutaneous surface.

Sources and causes of extra-renal suppuration.

Circumrenal abscess in its more ordinary forms, as the result of intrarenal suppuration, has found sufficient mention elsewhere. By far the most frequent of these is that in connection with calculus and produced by dilatation of the pelvis, disproportionate extension of one of the calyces, and perforation by it of the renal capsule. Tubercular suppuration also will sometimes reach the outside of the kidney, a suppurating mass impinging upon and penetrating the capsule and possibly entering the duodenum or descending colon. Pus of this origin, however, does not as a rule travel far or collect in great abundance, though I have referred to a case of psoas abscess from this cause (page 811). Abscesses of wide range have been known to ensue from the perforation of the capsule by pyæmic and 'surgical' renal abscesses. Instances of extensive extra-renal abscesses are related in connection with both these subjects.

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[1] See case quoted by Feron, *loc. cit.* p. 33.

Wounds

Wounds and contusions involving the kidney or its surroundings have been followed by suppuration about it. Wounds from the front necessarily open the peritoneum and are fatal by extravasation of urine within. But the kidney may be pierced from behind by a bullet or otherwise, so that the escape will take place into the posterior tissues, and spread more or less round the organ, with matter widely disposed but still behind the serous membrane. Such a case is described by Baudeur.[1] A musket-ball entered the left loin of a soldier, near the second lumbar vertebra; retraction of the testicle and painful emission of urine followed; a collection of matter then formed apparently between the kidney and the wall of the abdomen, which at last was reached by a sound introduced through the wound, and thus successfully got rid of.

and bruises.

Bruises of the lumbar region may also be followed by suppuration around the kidney.[2] A French peasant fell from a tree and severely bruised the right loin; hæmaturia at once followed, and then deep-seated pain, fever and lumbar swelling, with recurrent rigors; an incision outside the lumbo-sacral mass, where fluctuation had become evident, gave exit to a quantity of 'phlegmonous' pus, and was followed by recovery.[3] In another instance a nurse fell downstairs and struck her right side upon the edge of a pail. The urine became slightly and temporarily bloody; she had fever, delirium, and diarrhœa; swelling appeared in the lumbar region, levelling the costo-iliac hollow and extending into the right hypochondrium, filling the interval between the liver and the iliac fossa, and reaching to the left across the median line. An opening in the loin, begun with caustic potash and completed by puncture, gave exit to a profuse discharge of pus, and led to the recovery of the patient. The right leg had been paralysed for four or five days during the height of the disorder.

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[1] Quoted by Parmentier, *L'Union Médicale*, August 1862, p. 408.
[2] Berounbioux, quoted by Trousseau, *loc. cit.* vol. v. p. 338.
[3] Bienfait, quoted by Trousseau, *loc. cit.* vol. v. p. 339.

Strains.

Violent strains of the back have been followed by, and apparently have produced, abscess in the renal vicinity. Trousseau mentions the case of a workman in the plaster quarries who felt acute pain in the left lumbar region while lifting a heavy load. Tumefaction, redness, and widely lancinating pain were succeeded by deep fluctuation in the affected loin, incision, and the discharge of a quantity of pus, which was ascertained by means of a probe to come from immediately behind the left kidney. The patient recovered. It is probable that when suppuration thus follows a strain there occurs either some deep rupture of muscle or tendon, or possibly the final giving way of some part of the renal surface previously undermined by disease.

Other causes of perinephritis.

But there are other causes and shapes of perinephritis which are more obscure, and perhaps some are adduced which are problematical. The large amount of cellular tissue about the kidneys, and generally between the pelvis and the ribs, presents this interval as a favourable seat for disorders which are proper to this tissue, while the proximity of the region to other organs and to large vessels renders it liable to be invaded by matter which has taken its origin elsewhere. An abscess beginning in connection with some other organ, or in the cellular tissue itself as a result of pyæmia or some febrile or other general condition which invites suppuration, or possibly from some local cause, whether hydatids or of some sort to be less readily discovered, may, though entirely independent of the kidney, either begin in its immediate neighbourhood or so soon reach it to expatiate in the loose tissue around as to behave as if it had taken its origin in this organ.

The apposition of the large bowel to each kidney

Extension from bowel.

without the intervention of peritoneum is important, not only as allowing of the passage of matter from the kidney to the bowel, but also permitting it to pass in the reverse direction, from the bowel to the kidney. Abscesses, especially from stone, may escape into the ascending as well as into the descending colon,[1] though they do not so often do so; and we have evidence that matter may be directed from the circumference of the ascending colon to that of the right kidney, this transference of disease being, as it would seem, more frequent on the right side than the left, possibly because the looser peritoneal arrangements of the ascending colon give more room for the accumulation of pus than is to be found on the left side. A man swallowed a pin; this caused perforation of the ascending colon, and an extra-peritoneal abscess in the right lumbar region, which contained gas and fæcal matter.[2] And there is much probability that the anatomical associations of the beginning of the large bowel with the right kidney may serve to explain other cases of circumrenal suppuration, of which the origin is less obvious. A large abscess in this situation is described by M. Lemoine [3] as having its anterior wall formed by the cæcum and ascending colon. No ulceration of the bowel was found, but the beginning of the disorder had been marked by violent colic and vomiting; pus discharged through an incision made during life had been extremely fœtid; the kidney, which was surrounded by the matter, was softened externally, but evidently not its source; and it may at least be surmised that the origin of the disorder was intestinal.

A remarkable febrile disorder was described by Butter as the Plymouth Dockyard disease,[4] which must be con-

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[1] See Case related by Parmentier, *L'Union Médicale*, September 1862, p. 441.

[2] Parmentier. 'Sur les Abscess périnephrétiques,' *L'Union Médicale*, August, 1862, p. 408.

[3] 'Abscess Périnephrique,' M. Lemoine. *L'Union Médicale*, June 19, 863, p. 551.

[4] *Remarks on Irritative Fever, commonly called the Plymouth Dockyard Disease*, by Dr. Butter. Devonport, 1825.

Plymouth dockyard disease.

sidered to have been an endemic form of septicæmia, due to some localised poison which was not traced to its source. The symptoms were more nearly analogous to those which sometimes follow dissection wounds than to those of any of the specific fevers. Slight wounds or abrasions received in the dockyard were succeeded in a number of instances by intense fever, erysipelatous inflammations, effusions of serum and pus into the cellular tissue, localised gangrene, intense injection or inflammation of the ileo-cæcal region of the bowel, as discovered on *post-mortem* examination, and in two of fifteen cases by suppurative nephritis, or perinephritis. In one of these instances, 'the mesentery and meso-colon were vascular with red patches, the whole being amassed in sero-purulent fluid. The right kidney was completely disorganised, and changed into a mass like thick cream in colour and consistence. The left kidney was sound.' In the other case the lower part of the ileum and cæcum were inflamed nearly to gangrene, while behind the bowels and around the right kidney, which itself was healthy, was found a pint of pus. It may be conjectured that in these cases the pus may have travelled backwards from the ileo-cæcal region of the bowel, by way of the meso-colon, and a similar explanation may possibly apply to the origin of perinephritic abscess in typhoid—a pathological sequence which has been noticed though not explained.[1]

Pus, also, which has taken its origin in disease of, or operations upon, the rectum, has been known to creep up the subperitoneal tissue and reach the renal vicinity.[2]

Abscesses about kidney of puerperal origin.

The consequences of labour are unequivocally associated with suppuration in the neighbourhood of the kidney.

Iliac and other abscesses are apt to form, as is well known, in these circumstances, as results of venous absorption, and there is nothing to prevent the extension of matter from the iliac to the renal region. A case is described by Trousseau, in his admirable lecture on perinephritis, in which pus so produced invaded successively the right broad ligament, the circumrenal and the iliac regions. The abscess was first found in connection with the right uterine appendages, and acquired from thence two outlets, one into the bladder, the other into the vagina. An interval of improvement was followed by rigors, fever, pain in the right side, and swelling which filled up the right costo-iliac hollow. The iliac fossa at the same time was free from both swelling and pain, though later an abscess was detected in this situation. Both the lumbar and the iliac abscesses were opened, and the patient sank with diarrhœa and hectic. There was no *post-mortem* examination, but it was evident that the perinephritis was of uterine not renal origin, probably by way of the iliac veins, and also that the iliac was subsequent to, if not secondary to, the perirenal abscess. Pus collected around the kidney might easily, as Trousseau suggests, pass with the psoas muscle to the cellular tissue of the iliac fossa, and its passage in the contrary direction is equally easy.

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[1] Trousseau, *Clinical Lectures* (Sydenham Edition), vol. v. p. 343.
[2] Koenig, quoted by Ebstein, *Ziemssen's Cyclopædia*, vol. xv. p. 589.

Among the extra-renal causes of circumrenal abscess must be mentioned, upon the authority of Trousseau, one which rests, like some of the other causes which receive credence, upon inference during life rather than ascertainment after death. Perforation of the gall-bladder by a calculus was believed by this acute observer to have been the cause of suppurative perinephritis in a case which he relates. Severe hepatic colic, in the person of an old lady, was followed by symptoms of acute hepatitis, with inflammation of the gall-bladder and intense pain in the sub-hepatic region. Then there was fever, and severe general disturbance of the system; when all at once the pain extended to the right renal region, with the formation of an abscess there, which was ultimately opened, with a favourable result. In Trousseau's view a

From perforation of gall-bladder.

gall-stone had travelled through an ulceration in the gall-bladder, and reached, through intervening adhesions, the perinephric cellular tissue. Whether or no the stone traversed the considerable interval which separates the gall-bladder from the renal region, it is at least clear, as the narrator observes, that hepatic colic was succeeded by circumrenal abscess.

From hydatids.

Circumrenal, or deep lumbar abscess, has been traced to hydatids, originating probably in the cellular tissue. In a case recorded by Feron[1] these, mingled with pus, came out of an incision which had been made in a tumour in the lumbar region, and was succeeded by recovery. An abscess in the adipose tissue about the kidney has been known to ensue upon removal of the testicle and the subsequent application of a ligature which included all the structures of the spermatic cord. The pus was serous and fœtid, and the cellular tissue about the spermatic cord was infiltrated with the same matter. It was supposed that the secondary suppuration was due in this case to the irritation of the nerve and the attendant pain; but I venture to think it more probable that the inflammatory process was conveyed by mere continuity either of cellular tissue or of venous channels from the place of the ligature to the place of the abscess. I have seen a bulky inflammatory infiltration of the whole length of the spermatic cord as the result of an operation involving its lower end.

From removal of testicle.

Mere neuralgia has been supposed by Trousseau, though perhaps on insufficient evidence, to be efficient as a cause of similarly localised suppuration. It has been traced to pyæmia, and stated to have followed upon other febrile conditions, among which variola and typhus have been mentioned. It has also been attributed to cold, but this must be regarded as more than doubtful.

From pyæmia and fevers.

As an example of perinephritis more than usually obscure in origin, the following case may be cited. It is related by Dr. Turner in the fourth volume of the

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[1] Thesis, by M. Feron, *De la Périnéphrite primitive*, p. 42.

'Transactions of the College of Physicians,' and occurred in the year 1806.

Case of perinephritis of doubtful origin.

A married lady, twenty-nine years of age, of corpulent figure, sat for some time in a current of air after having been heated by long riding on horseback. In the evening she vomited and had much pain in the bowels, which disturbance was attributed to some lobster she had eaten for supper. She was temporarily relieved by an aperient, but on the following night had much pain in the back and loins. She then became restless and anxious, with cold extremities and total loss of radial pulse. The features became livid and drawn, and she gradually sank, retaining consciousness to the last. The urine had been passed without pain or difficulty, and was not noticed to be less copious than common. The illness did not occupy quite two days, extending from Saturday evening to Monday afternoon.

On dissection 'the whole of the adipose substance surrounding both kidneys was in a gangrenous state exhibiting a large mass of black pulpy matter. The capsules of both kidneys were inflamed, and that of the right kidney partly mortified; slight traces of inflammation were also found in the internal structure of both kidneys.'

Slight marks of inflammation were found on the peritoneal coat of the stomach, and the part of the colon which lies over the left kidney was much inflamed. Five stones were found in the gall-bladder.

The pancreas was 'inflamed throughout its whole substance, and a considerable portion of its left extremity was in a state of mortification.'

Dr. Turner considered that the disease was inflammation rapidly proceeding to mortification primarily attacking the fat about the kidneys, which was in excessive quantity, and thence extending to the pancreas and colon. He regarded the long continued riding on horseback as the exciting cause.

It may be suggested as a not impossible explanation that the condition described as inflammation and gangrene, may have been one of extravasation of blood into the cellular tissue and fat about the kidneys, such as might have resulted from the laceration of an artery, or the rupture of a small aneurism. But whether any such undiscovered cause of local inflammation may have existed in this case, it must at least be accepted as a possibility that suppurative perinephritis may take place without any preceding organic lesion.

I may relate a case in point, for the opportunity of seeing which in life and after death I am indebted to my friend Dr. Parr.

Case of perinephritis from bruising in a tuberculous subject.

A gentleman who had habitually drank much, but had recently lived poorly as regards food, left Queensland for England in July 1879, he being then forty-three years of age. The passage was exceptionally stormy and wet, so that he was scarcely ever dry. He passed the time mostly lying in his bunk, and from its shape usually on his left side; the rolling and tossing were incessant, and on his arrival in England in October, the whole left side was extensively ecchymosed. In the following May he was first seen by Dr. Parr, and shortly afterwards by myself also. He was then thin and worn, like a man wasted by chronic disease, he had sweated much at night, and his skin was generally rough and somewhat scaly, as it sometimes becomes after chronic febrile, particularly tubercular conditions. The pulse was 100; the temperature 101. Our attention was drawn especially to lumbar pain and constipation. The pain was somewhat general in the left lumbar region, which was indefinitely swollen or full as compared with the other, and was tender, particularly at a spot near the edge of the quadratus muscle. Dulness and tubular breathing were detected in the left lung, most marked about its base, but evident also in the apex. There was slight cough and occasional morning expectoration. There had been no hæmoptysis, nor was there any tubercular history in the family. In the course of June the tender spot in the loin presented fluctuation, and was opened by Dr. Parr, with the evacuation of about three pints of laudable pus. Into the incision a drainage-tube was after a few days introduced, when it was found that whenever the patient coughed or sneezed a puff of air came through the tube, so as to blow aside the flame of a candle. The discharge, which was for a time continued and copious, gradually lessened; the wound closed in a corresponding degree, and finally healed in July, a month after incision. He had gained flesh and strength with its closure, but the gain proved temporary. In September he had hæmoptysis for the first time. This was succeeded by profuse purulent expectoration, which in October amounted to fifteen ounces daily. Under this emaciation and weakness increased, until he sank in December 1880.

On *post-mortem* examination a large empty abscess-cavity was found behind the peritoneum, in close apposition to the outer side of the capsule of the left kidney. The cavity was collapsed, but was very extensive in the cellular tissue between the kidney and the lumbar muscles. This had two exits. A large burrow, into which the finger could be passed, went through the sacro-sciatic foramen, and presented itself, after a tortuous course, upon the loin, terminating under the skin near the cicatrix of the wound which had given issue to the discharge. The other exit passed upwards by a small hole through the diaphragm, across the pleural cavity, or rather through thick adhesions which had closed it, into the base of the left lung, and thence upwards through an ulcerated channel, large enough to admit the finger into a large bronchus near the back of the lung, at a point about equidistant between its base and apex. This lung was generally spotted with recent tubercle, and a large ragged vomica was found at its apex. The right lung likewise contained scattered crude tubercle, though in small amount, and, as on the other side, of recent date.

Both kidneys were healthy. The capsule of the left, upon the outside of which was the abscess, was much thickened, and was adherent to the neighbouring structures, but no disease could be found in the organ itself. The spine and pelvis were carefully examined for diseased or exposed bone, but none could be found. Nothing else needs mention excepting that the liver was in a marked condition of cirrhosis, as shown chiefly by the fine globulation of its tissue. It was also fatty, and the cystic duct was closed by a collection of cretaceous matter.

General symptoms.

The leading facts in regard to the symptoms of this morbid condition have been involved in the preceding account of its nature and origin. Occurring as it does in widely different circumstances, it takes as different shapes, appearing sometimes, as in the Plymouth Dockyard cases, as part of a severe and acute febrile disease, at other times with the sluggish temper of lumbar or psoas abscess in their most chronic forms. In its more ordinary kinds an early symptom is deep-seated lumbar pain, severe and lancinating or of a pricking character, with tenderness, possibly not superficial, but evident upon deep handling of the lumbar region. With this, or soon after it, or possibly before there is enough of either pain or swelling to attract notice, comes fever. This is of the continued type, with evening exacerbations and possibly nightly sweatings, like the fever of tuberculosis, which it often resembles, or with which it is often associated. Rigors are commonly observed, and have been known to occur with quotidian regularity. With all this there is much general illness and loss of appetite, and of flesh, with possibly nausea, vomiting, and constipation. Sooner or later the swelling which I have already referred to shows itself in the back, filling one of the lumbar hollows, giving an undue sense of fulness between the hands placed before and behind, and finally causing the brawny or doughy state of surface which indicates the approach or presence of pus. The posture is supine, or, if the psoas be implicated, the patient may sit as described by Dr. Bowditch on one gluteus, and have the bent leg characteristic of psoas abscess.

Duration.

The great range of duration which the disorder presents is sufficiently evident from what has been already said. It often terminates, as in the Plymouth cases, before the matter has had time to present externally. When it has so done the course of disorder, according to Feron, is still so rapid that in most cases the abscess is completely formed and evacuated within three months. But there are many instances, such as those connected with calculus, in which the abscess, perhaps sometimes partially closing and opening again, may extend over years, or last indefinitely.

Urine.

The urine in these cases has relation rather to the presence or absence of some of the causes to which perinephritis may be due than to the affection itself. It gives no evidence of the presence of the extra-renal suppuration, but may declare, by blood or pus, the presence of a bruise or laceration of the kidney, or of stone or tubercle within it.

Dr. Duffin collected twenty-six cases to ascertain the frequency of urinary complications. 'Two had been produced by an injury to the loin, and had bloody urine; six had free pus; two bladder signs; five kidney disease without bladder signs; and no less than twelve had no urinary complication whatever.'[1]

Treatment.

With regard to the treatment of circumrenal abscess, it is needless to say that if once the matter be formed there is nothing to be done but to provide for its escape. Incision or puncture has usually been practised in the loin, an opening sometimes having been effected, at the bottom of which the kidney could be felt with the finger. The average of success has been good, and would have been better were it not that the suppuration is dependent perhaps, in most cases, upon incurable disease. Dr. Duffin tells us that of twenty cases he collected, in which abscess in this position was treated by early puncture through the loin, the operation in two was followed by death—in one from peritonitis—while in eighteen it was 'attended with a considerable modicum of success,' in twelve with complete recovery.[2] It is to be presumed that in these days of the aspirator, puncture by its means will sometimes supersede the old incision, though it must often happen, as when stone or tubercle have given origin to the matter, that a continuous opening is inevitable. As one of the dangers of incision must be mentioned reiterated hæmorrhage, which proved fatal in a case recorded by Parmentier.[3]

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[1] Duffin. *Path. Trans.* vol. xxiv. p. 141.

[2] Duffin. Case of perinephric abscess, *Medical Times*, September 1870, p. 362. See also conclusion of case, *Path. Trans.* vol. xxiv. p. 138.

[3] *L'Union Médicale*, September 1862, p. 575.

CHAPTER IV.

THROMBOSIS AND EMBOLISM.

Thrombosis.

Definition.

When the blood coagulates in its own vessels and there remains, *thrombosis* is said to occur; *embolism* when the vessels are obstructed by matters brought from a distance. These two conditions are, as will be seen, different in their cause, in their seat, in their progress, and in their results. Our present concern is with thrombosis.

It has long been recognised that the blood is apt to coagulate in its vessels during life as well as after death. This may occur in many situations and circumstances; sometimes in arteries, more often in veins. It may be limited to one vessel or one system of vessels, or may occur simultaneously in many parts of the body.

The knowledge that clot sometimes forms during life in the veins of the kidney is nothing new in pathology, though from its comparative infrequency it occasionally drops out of notice, to reappear like an old fashion restored with the freshness of novelty. John Hunter has described it minutely.

Morbid anatomy.

The coagulation takes place, almost without exception, in the veins, not in the arteries. Dr. Moxon has related two cases (see footnote, p. 691) in which, after injury, clots were found in the renal vessels of both kinds. These cases, which in many respects resemble embolism rather than thrombosis, form the exception. The clotting may involve one gland only, or both simultaneously. A kidney in which general thrombosis has recently occurred is increased in size and feels unnaturally hard. In section it is seen that many or all the veins which can be followed with the naked eye are occupied with coagulum, which, according to its date and degree of decolorisation, may be black, brick-red, or buff. These coagula are usually continuous through many subdivisions and ramifications, and sometimes occupy the entire venous system of the organ, from the vena cava to the finest branches which can be reached by dissection. Beyond these the microscope will sometimes show that the minutest veins and capillaries are loaded with blood, sometimes even to bursting. The clots are often adherent to the veins, the coats of which remain natural.

In many cases this change befalls kidneys which have previously been the seat of disease whereby the circulation through them has become impeded. Sometimes, besides the renal system of veins, those of the lower extremity and the portal vein are similarly affected, while clots have also been found at the same time in the heart and other situations.

The rapidity with which the disease, when general throughout the kidneys, proves fatal gives no time for such slow degenerative changes as occur in coagulum in less lethal situations. When, however, it has been limited to one kidney, or to a part of one kidney, a process of fatty softening occurs, such as is very common in connection with an embolic block. In the case of a man who died at St. George's Hospital with thrombosis, evidently of old date, affecting the renal, supra-renal, and iliac veins, the anterior half of the affected kidney was occupied by a soft pinkish mass, of the consistence of putty, which under the microscope appeared to consist mainly of oil-globules.[1]

Coagulation of the blood during life may be produced by inequality or change of character in the surfaces over which it flows, by retardation of its current, or by a morbid change in the blood itself.[1]

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[1] Reported by Dr. J. W. Ogle in the *Path. Trans.* vol. vii. p. 177.

We often see coagulation determined by alterations of surface in the collection of fibrine upon valves and arterial surfaces; but in the kidney, where, apart from embolism, it takes place especially in the veins, we seldom see the operation of this cause. With regard to this organ, it may be stated that the causes of coagulation are mainly of two kinds:— Causes.

1. Retardation of the circulation by narrowing of the vessels.

2. Morbid coagulability of the blood.

Narrowing of vessels,

Considering, first, narrowing of the vessels as a cause of renal thrombosis, this occurs in its simplest form when the veins are narrowed and their current obstructed by morbid growths outside them. A case of this kind is reported by Mr. Sibley, in the 'Transactions of the Pathological Society,'[2] in which coagula were formed in the vena cava, the veins of both upper and lower limbs, and the renal veins, in consequence of the infiltration of the tissues surrounding the inferior cava, iliac, and axillary veins, by a cancerous growth.

in connection with renal disease.

We see the same result produced by vascular constriction of a different kind, in the frequency with which renal thrombosis is associated with chronic disease of the kidney. This must be in part, though, as I shall presently show, not entirely, attributed to the hindrance which occurs to the circulation from the encroachment of fibroid growth, the pressure of distended tubes, or the lardaceous thickening of the arterial coats. Under these conditions the blood reaches the veins with its velocity unnaturally diminished, and is accordingly disposed, until it reaches the main stream of the vena cava, to coagulate. The degree to which the renal vessels are obstructed by disease may be easily demonstrated by the simple expedient of allowing water to flow into the renal artery of a healthy and of a granular kidney. It will be found that water traverses the diseased organ with extraordinary slowness compared with the healthy one.[1]

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[1] I have discussed the causes of the coagulation of blood in the living body in more detail in a paper upon the Coagulation of Blood in the Cerebral Arteries, *St. George's Hospital Reports*, vol. i. p. 257.

[2] *Path. Trans.* vol. ix. p. 128.

State of blood.

Independently of local or organic alterations coagulation may depend upon an unnatural tendency of the blood to deposit fibrine. This is fully as important in relation to renal thrombosis as narrowing of the vascular channels. There are many conditions of system in which the blood is apt to congeal where its current is slowest. Such a state appears to belong to many conditions of prostration, exhaustion, and febrile disturbance. Under such general influences coagula are apt to form simultaneously in more than one system of vessels, the renal clotting being associated with a similar change elsewhere. The renal veins sometimes share with the femoral in the coagulating process which is apt to follow parturition. A young woman, who had been delivered six weeks before, was brought into the hospital with phlegmasia dolens affecting both lower extremities. After death, which occurred nine days later, coagula of distinctly *ante-mortem* character were found generally distributed in the veins of the uterine organs, pelvis and lower extremities, and also in those of the right kidney. Renal thrombosis has been known to occur in other states of systemic disturbance, as in typhus.

The febrile condition, of whatever nature it be, appears to be a possible cause of coagulation; that this could be produced experimentally by an increased temperature was long ago shown by Hewson. It is not needful, however, to discuss the causes of thrombosis in general; its association with anæmia and prostration, with gout and, though rarely, with rheumatism, is well known. On whatever cause it depend the kidney may be its location. Finally, as a cause of thrombosis which is directed especially upon the kidney because it is usually associated with structural disease of that organ, must be mentioned the effect upon the blood of long-continued albuminous discharges, whether purulent or of the nature of albuminuria.

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[1] I have related some observations of this kind in the *Med.-Chir. Trans.* for 1860, p. 242.

By such means we must infer that the composition of the blood is altered by the withdrawal of its albuminous part, leaving the coagulable element in relative excess. Thus we may account for the frequent occurrence of thrombosis in connection with lardaceous disease. The lardaceous change and the morbid coagulability of blood result in common from exhausting discharges. When the kidneys themselves are the seat of chronic disease, involving the loss of albumen, they are exposed to a double chance of thrombosis. The blood in their vessels, as elsewhere, is rendered morbidly coagulable by the drain; their circulation is impeded by local disease. This co-operation of obstruction with coagulability accounts for the frequency of thrombosis in connection with chronic albuminuria.

Double action of albuminuria as cause of thrombosis.

The symptoms of this fatal alteration are not sufficiently definite, or are too often masked by the results of antecedent disease, to lead to its detection during life; but the salient points of its clinical history can be discerned by following back the history of the cases in which it has been discovered. Originating, as it does, in connection with exhausting disease, albuminuria, or some febrile state, its especial manifestations are apt to be overlooked or misinterpreted.

Symptoms.

From the fact that instances of general renal thrombosis seldom come to view, as more partial clots often do, in a state of degeneration or change bearing record of the handiwork of time, but the condition is nearly always recent at the time of death, we must infer that it is usually rapidly fatal.

Its fatality when general.

The condition of the patient is generally, either from the disease itself or its antecedents, one of extreme prostration. The urine appears to be highly albuminous, sometimes bloody, and much reduced in quantity, as if

Urine.

from any other cause the kidneys were in a state of intense injection. If the arteries as well as the veins are generally obstructed (as in the case referred to in footnote, p. 691), there may be, or rather, if the condition is complete, there must be, total suppression. The presence of albumen or blood in the urine in connection with thrombosis is sometimes equivocal, as when this condition ensues upon renal disease; but it is equally to be observed when the kidneys have been previously healthy, as in the instance related by Mr. Pick. Renal pain has not been noticed in connection with this disorder.

Œdema.

Limited or general œdema is necessarily often present with it, as the iliac veins may share in the condition, or kidney disease cause it; but it does not appear that this symptom has been traced to renal thrombosis pure and simple, though such a result is probable.

Recovery when condition is partial.

Recovery may ensue when the renal coagulation has been only partial. An instance has been given in which thrombosis affecting one kidney only was found after death in a state which sufficiently proved that it had occurred a long time before (p. 684). It is probable that partial renal coagulation would produce symptoms resembling those which belong to the more common and more easily recognised condition of embolism. The infrequency of renal thrombosis is such that one may wait long for opportunities of observation.

The following cases may help to render less incomplete the fragmentary account which I have given of this disease. The first is of classical interest.

Among John Hunter's preparations at the College of Surgeons is a kidney, the veins of which are filled even to their small branches with fibrinous coagula.[1]

According to Hunter's manuscript, this was obtained from the body of Lady Beauchamp under the following circumstances. An abscess formed in the neighbourhood of the hip joint, but not apparently in connection with it. This was opened and remained so for four months, after which the wound took on an unhealthy appearance and the patient sank, with quick pulse, pains in the right side, and much irritability of the stomach.

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[1] See Preparation 1926 in the College of Surgeons Museum.

All the organs were natural excepting the right kidney, which is thus described by Hunter: 'This viscus was larger than natural, much harder or solider, and of a dark red. Upon its surface lay some extravasated blood, which must have been recent from its appearance, and which might have given rise to the pain in the side before mentioned. On slitting open the inferior vena cava we found a ragged coagulum of blood sticking in, and almost shutting up, the orifice of the right emulgent vein. On slitting up that vein we found it almost choked up with coagulated blood throughout its whole length, and in its ramifications as far as we could trace them. This coagulum was strongest and densest close to the coats of the vein; in its centre spongy and cellular. It would appear that this disease was in all the ramifications of the kidney, as it was loaded with blood which did not ooze out when cut into. The pelvis was almost obliterated by the pressure of the kidney on the sides.'

The abscess in the thigh exposed the great trochanter, but did not enter the joint.

The condition of kidney is described with a minute accuracy which requires nothing to be added or altered to make it a complete exemplification of the morbid anatomy of the disease.

The patient had long suffered from an exhausting disease, and whether or not lardaceous change had as yet resulted, the blood had probably been considerably modified by the suppurative drain.

The following case occurred in St. George's Hospital in the year 1844:—

General dropsy, much exhaustion, urine diminished in quantity, death apparently from dyspnœa. Coagula in veins both of liver and kidneys.

Caroline Phillips, forty years of age, was admitted under the care of Dr. Wilson, with general anasarca and ascites, and in a state of great exhaustion, having been brought out of her bed, to which she had been for eleven weeks confined. The urine was reported to have been copious until the last few days, when it had fallen off very much in quantity. It was not tested for albumen during life. She had been suffering extremely from dyspnœa.

This symptom became much aggravated on the second night after her admission, when she died apparently suffocated.

The *post-mortem* examination was made by Mr. Prescott Hewett, who was at that time curator, and is thus described. Much serum and some gelatinous-looking lymph in both pleura. Old pleural adhesions in right side. Lower lobe of left lung gorged with frothy serum.

Small quantity of clear fluid in pericardium. Heart small, healthy, the coagula contained in its cavities were large, loose, and partly fibrinous.

The peritoneum contained a large quantity of turbid serum, with transparent gelatinous-looking lymph. Liver large and fawn-coloured; tissue slightly fatty. The portal vein in the transverse fissure was plugged up by a large coagulum filling both its branches, which externally was quite firm, and of a mottled colour, internally soft and looking to the naked eye like a mixture of pus and blood. These coagula were traced into some of the larger branches of the portal system of the liver. Coats of veins quite transparent and of a healthy appearance. Both kidneys large, of a pale mottled fawn colour on their surfaces, and quite smooth. The cortical structure appeared to be increased in depth, but it throughout presented the characters of the mottled degeneration. Veins of both kidneys were plugged up by coagula, reaching into some of their larger ramifications, and resembling the coagula in the portal vein. The coats of the renal veins were healthy. The vena cava inferior contained natural coagula, other viscera natural.

This case is an example of a general tendency to coagulation, probably in consequence of chronic albuminuria. It is worth observing in connection with the effect of obstructed local circulation in determining the formation of clots, that both the organs in which coagula were found, namely the liver and kidney, were diseased and probably lardaceous.

Double renal thrombosis, with coagulation in iliac vein and gangrene of lung.

A woman of intemperate habits died in St. George's Hospital at the age of forty-two, with œdema of the left leg, and symptoms of gangrene of both lungs. The urine was albuminous, and on one occasion contained blood. The left iliac vein was blocked by a firm coagulum which was adherent to the walls of the vessel.

'The left kidney was much larger than the right, and was of a buff colour, resembling in appearance a fatty kidney; it was, however, very firm, hard, and full. On section the veins were found to be filled with *ante-mortem* clots, which had entirely lost their colour, and were adherent to the walls of the vessels. The coagulum extended into the minutest ramifications and gave the surface of the kidney a peculiarly mottled appearance. It filled the whole of the renal veins as far as the vena cava, and extended a short distance into the spermatic vein. Upon microscopic examination the capillaries were found to be much distended and quite full of blood. In places, vessels had given way and minute extravasation taken place, which had compressed the tubes, rendering them irregular, contracted, and resembling somewhat the tubes in granular degeneration.' [1]

The course of events in this case was probably as follows: Morbid coagulability of blood from some septic or other cause, coagulation in the renal and iliac veins, detachment of portions of the clot and their impaction in the pulmonary vessels, causing gangrene by obstruction, or possibly by infection, were there any infective source of the primary clot.

The albuminous and bloody condition of the urine could be attributed only to the thrombosis, as the kidney not thus affected was natural in all respects.

An instance is recorded by Dr. Moxon in which both kidneys were affected in this manner, together with the veins of the left lower extremity. The kidneys were large, white, and probably lardaceous. There was a spot of gangrene on the buttock, and a gangrenous cavity in the left lung. The immediate cause of death was meningitis, which probably had a pyæmic origin. The condition of the patient had been one of febrile prostration like that of typhus.[2]

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[1] Reported by Mr. Pick, *Path. Trans.* vol. xx. p. 229.

[2] Two cases of much interest have been reported by Dr. Moxon (*Guy's Hospital Reports* for 1868, vol. xiv. pp. 88, 89), where contusions of the lumbar region were followed by the formation of coagula in both arteries and veins of one or both kidneys. A woman advanced in pregnancy fell in an upright position between a moving railway carriage and the platform, and was thus subjected to a rolling process, by which the right kidney was ruptured, its ureter torn in two, and the spines broken from all the lumbar vertebræ. This was followed by vomiting, abdominal pain, and increasing prostration, suppression of urine complete, except that a small quantity was passed on the fifth day, the delivery of a still-born child, and death 135 hours after the accident. The right kidney was extensively bruised and torn, and the

Treatment. As this affection of the kidney has hitherto escaped recognition during life, the consideration of its treatment would seem superfluous. Should the condition be detected, it is obvious that drugs which lessen coagulability, of which the fixed alkalies are the most trustworthy, would be called for.

EMBOLISM

Definition. The impaction of erratic masses of fibrine in the vessels—embolism, as it is termed—has, since the observations of Kirkes and Virchow, been clearly distinguished from the fixation of coagulum in the place of its formation, which is known as thrombosis. The results of embolism vary in different organs, with the distribution of the arteries and the properties of the tissue, but they are

ureter severed just below the pelvis. All the vessels, arteries as well as veins, were blocked with *ante-mortem* clot, which reached as far in each case as the principal vessel; the clot in the vein was unadherent, that in the artery adherent, as if it had long been present. No wound was found in the arterial coats. The tissue of the kidney was yellow and opaque.—The second case is that of a man who was knocked down by a railway engine, which broke the second and third lumbar vertebræ, and killed him in eight days. The right kidney was swollen, yellow, and opaque, the whole organ presenting the appearance usually seen in parts of it as the result of cardiac embolism. All the vessels, arteries as well as veins, were obstructed by *ante-mortem* clot, which distended the vessels and adhered slightly to their sides. The lower fourth of the left kidney, which was separated from the upper three-fourths by a zone of congestion such as usually surrounds embolic patches, was in the same state as the whole of the right, its vessels obstructed and its tissues pale and homogeneous. No *ante-mortem* clots were found in the heart or great vessels. The broad conclusion of these cases is clear, that violence, involving the renal region, has given rise to the deposition of coagula in the vessels of previously healthy kidneys; it is also little to be doubted that the coagula presented themselves first in the arteries, in the veins secondarily. But whether the arterial obstruction was of the nature of thrombosis, as Dr. Moxon holds, or whether it was embolic, as his clear description would lead one to think, is a question which must await its answer. No clots which could be a source of embolism were discovered, though the character of the lesion would appear to point to some such process. Had there been any injury to the inner coat of the renal artery, from whence clots had been carried into the further circulation, it would have satisfactorily explained the affection, but none such was found. Dr. Moxon's suggestion, that the blood clotted in the organs in consequence of the death of their tissue, as a result of the crushing force to which they were subjected, is somewhat hypothetical, and perhaps is scarcely consistent with the absence, after as long an interval in one case as eight days, of the changes which ordinarily ensue upon the death of a soft tissue.

generally easily recognisable, and nowhere present more striking and constant characters than those of the well-known 'fibrinous block,' which is the form they take in the kidneys. The left cavities of the heart furnish, as would be supposed, the ordinary source of the emboli which enter the kidney. Whenever accumulated fibrine is broken from the valves or walls, an accident which is of continual occurrence in cardiac disease, more especially in endocarditis of recent date, the fragment is liable to be swept, by their copious and direct arterial supply, into one or other kidney.

There is certainly no organ in which the results of embolism are so often noticed as in this, though it would be too much to assert that there is no position in which they so frequently occur.

The earliest alteration in the kidney which declares to the naked eye that loose fibrine has been swept into its artery is circumscribed injection or extravasation. Of this there may be one or many patches, each patch indicating a separate lodgment.

General morbid appearances.

Often a patch or ring of injection of considerable size is found upon the surface, or, as happened in a case in which I detected the change at a very early period,[1] a congested circle about as large as a sixpence was surrounded by a white margin. Later the appearances become more characteristic. Hard, dense, straw-coloured edges, bordered by vivid congestion, are seen in section, the point of the wedge being in a cone, the diverging lines crossing the cortex, the base abutting upon the capsule. When the wedges or cones are small, as is the case when the fibrine is confined to the territory of one of the smaller arteries, the arrangement as described is distinctly seen. More rarely the change involves a large proportion of the organ, often at one end; the conical disposition is then necessarily obscured. As much as a third of the gland, or even more, may be thus transformed, the fibrine filling one of the larger subdivisions of the renal artery, and permeating the whole of its field of distribution.

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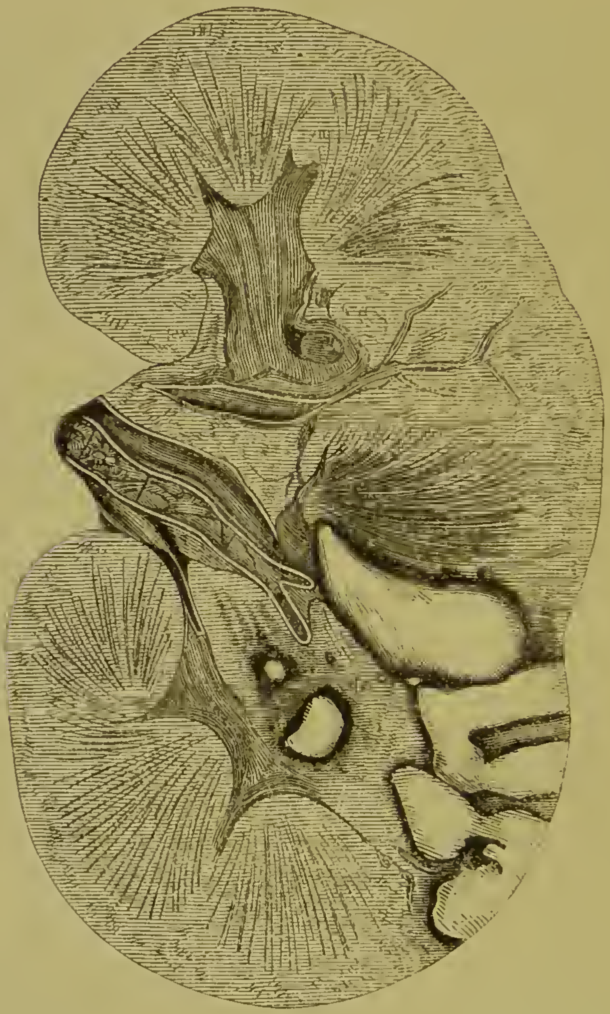
[1] *Pathological Transactions*, vol. xiii. p. 46.

Under these circumstances, a careful dissection will often show that the artery leading to the block is plugged with fibrine; this, however, is not always the case. Unless the intruded material is very abundant, the minute vessels fill first. The blocks are so different in colour and texture from the surrounding tissue that they look like masses foreign to the kidney, and inserted into it. A close examination, however, even with the naked eye, will often reveal pale lines and spots, which show that the vessels and malpighian bodies still hold their



Embolic block in kidney, the obstruction extending into renal artery. (From a drawing at St. George's Hospital.)

position, though they have lost their colour. The blocks are sometimes raised upon the surface, owing to the distension of their vessels by the intruding material.

As time goes on the vivid injection around them fades, their light bright colour becomes duller and yellower, the resilient hardness gives way to a puffy, greasy friability; they no longer protrude upon the surface, but they shrink as they soften, and, through stages of fatty transformation and absorption, disappear, leaving a depressed indurated cicatrix as the only record of their existence. If the infiltration has been extensive a large proportion of the organ may be destroyed by this means. Dr. Van der Byl describes a kidney from a case in which embolic blocking had occurred in many organs, which 'weighed only an ounce and a half; it was much deformed, and consisted for the most part of firm yellowish substance, very little of the renal structure remaining free from deposit.'[1] It was clear, from the history and surroundings of the case, that this extreme destruction of renal substance had been produced embolically.

Minute anatomy.

The microscope enables us to add a few particulars. At an early stage there is no change in the kidney save blocking of the vessels in a limited area, and sanguineous distension of those around. The obstructing material is amorphous or finely granular, sometimes blood-tinged or mixed with corpuscles. It appears to consist mainly of comminuted fibrine. It is found in the arteries and capillaries, not in the veins. The material evidently penetrates the smaller arteries with facility, but cannot get through the capillaries. In the capillaries, therefore, or in the smallest arteries, the arrest takes place, and the intruded material accumulates, behind the stoppage, mounting, according to its abundance, in larger and larger vessels. The straight vessels of the cones, and those which pass thence to the cortex, are more often blocked than the malpighian capillaries. The clot passes more readily into the branches of the renal artery which enter the cones directly than into those which supply the malpighian bodies. The latter are perhaps less easily entered, given off as they are at an abrupt angle. The knowledge that the cones receive vessels directly from the renal artery enables us to understand facts connected with renal disease which would be otherwise incomprehensible. It used to be thought that all the blood of the renal artery passed through the malpighian bodies before going to the tubes. On such a supposition the disposition of fibrinous blocks is inexplicable. Did such a disposition of vessels exist it would be hard to explain the fact, often observed, that fibrine injected by the arteries should be found in the intertubular, while none is to be seen in the malpighian capillaries. The coarse material appears to be unable to pass through vessels of the capillary size, and must necessarily be arrested in the malpighian bodies, if it reach them first. Dr. George Johnson[1] has been led by this imperfect view of the renal circulation to maintain that the blocks, which are generally, and, as I have endeavoured to show, truly, regarded as embolic, are the result of the coagulation of blood *in situ*. This view, however, is refuted by the exemption of the veins from obstruction, by the abrupt limitation of each block to the territory of its own artery, and by their invariable association with fibrinous deposits in the heart or elsewhere in the course of the blood which flows to the kidney. Coagulation *in situ* occurs, as has been shown, in different circumstances, mainly in the veins, and without abrupt limitation.

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[1] *Path. Trans.* vol. vii. p. 168.

Mode of production.

In recent blocks the only change is in the contents of the vessels; the stationary structures within the block soon, however, along with the contents of the vessels, undergo degenerative transformations. The impacted fibrine rapidly becomes fatty, and a similar alteration affects the tubes and other renal elements. General fatty disintegration ensues within the affected region, the broken-down tissues are absorbed, until at last only the puckered cicatrix remains, which has been referred to in connection with the naked-eye appearances.

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[1] 'On the Minute Anatomy of the so-called Fibrinous Deposits in the Kidneys,' *Path. Trans.* vol. ix. p. 305.

Symptoms.

The renal changes which have been described necessarily result, as a rule, from disease of the left side of the heart. Rheumatic endocarditis often gives rise to them, as also do more chronic valvular affections, particularly if they be accompanied with the deposition of fibrine upon the auricular or ventricular wall. The blocking of the kidney, if it occur alone, is seldom of much clinical importance; unless extensive, it often escapes recognition during life, the symptoms being obscured by the other results of the cardiac disease in which it takes its origin. The impaction may be marked by shivering and succeeded by fever,[1] but these perhaps more often occur when the dissemination is general or widely distributed than where it is only renal. The symptoms of the renal localisation are, however, tolerably well marked, and would no doubt be more often found were they more generally understood. The urine becomes suddenly albuminous, often bloody, and at the same time there is sudden and sometimes violent pain in one or the other renal region. With this, should the affection of the kidney be extensive, there may be vomiting and more or less collapse. When the impaction is of small extent, little further may occur than a suddenly albuminous state of the urine, which is usually of high, or at least of unaffected, specific gravity. It contains, besides albumen, blood-corpuscles and numerous tube-casts. The casts are of moderate diameter, and are more often simply fibrinous than of any other kind. It is probable that the change in the urine is not due to any general disturbance of secretion throughout the kidney, but simply to a species of circumscribed nephritis in the block itself and its intensely congested vicinity.

Urine.

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[1] See cases reported by W. H. Dickinson, *Brit. Med. Journ.* May 21, 1881.

The urine gradually resumes its natural character; the pain, should there have been any, is of short duration, and, after a few days or weeks, all symptoms of the disturbance have passed away. The block is still in the kidney, but it is no longer a source of irritation.

Blocking of other systems of vessels, particularly of the cerebral, often occurs simultaneously with the renal impaction, and proportionally aggravates the symptoms. Cerebral embolism especially is apt to be attended not only with cerebral disturbance, but with severe, and often rapidly fatal febrile prostration. Such symptoms, however, do not appear to occur when the kidney only is affected.

Cases showing ordinary effects of embolism.

A young woman with mitral disease of rheumatic origin, displayed, to the observation of Dr. Gairdner, the symptoms of renal embolism with much explicitness.[1] The urine was at first natural. She then had a severe rigor lasting half an hour, followed by profuse sweating, pain in the left side of the abdomen, and tenderness in the left renal region. The urine became at once scanty, lithatic, bloody, and highly albuminous, and shortly afterwards displayed epithelial and granular casts in abundance. Later tube-casts containing pus-corpuscles were found, while pus was evident as a loose deposit. The blood-tinge continued in the urine for about a week. After three weeks the albumen could be detected only as an occasional trace, one or two hyaline casts being likewise occasionally found. The urine was at first lithatic and of high specific gravity (1030–1037); later it became of normal specific gravity and appearance, and gave deposits of oxalate and crystalline phosphate of lime.

Subsequently to the attack which thus affected the urine were others of shivering and feverishness, dependent also, probably, on embolism. In the course of them the radial artery ceased to pulsate, probably from an obstruction of this nature. *Post-mortem* proof of the cause of the attacks was fortunately wanting as the patient left the hospital comparatively well; there could, however, be no doubt as to their origin.

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[1] 'Report of Renal Cases in Professor Gairdner's Clinique,' by Dr. Finlayson, *Glasgow Med. Journ.* 1874, p. 44.

Dr. Hermann Weber[1] brought an instructive case of this affection before the Pathological Society.

A woman who had old disease of the mitral valve was suddenly seized with violent pain in the right side just below the twelfth rib, with great collapse, vomiting, and diarrhœa, the pain being increased by pressure. These symptoms abated after two days. A week afterwards a similar but more violent attack occurred, the pain this time being on the left side, lasting almost a week, with varying intensity, and being only relieved by frequent subcutaneous injections of morphia. The urine, which had exhibited only a very small quantity of albumen before these attacks, became highly albuminous during and for about a fortnight after this occurrence, containing many tube-casts of various kinds, but principally of the transparent variety. Afterwards the urine resumed its natural characters, being free from albumen and casts. Traces only of blood were found for a few days at the time of the attacks. Anasarca of the lower extremities which had before been moderate, increased upon the attacks, and diminished with the albumen.

The patient died of pulmonary apoplexy, thirty-eight days after the first attack of renal pain. The right kidney contained in its centre a pale yellowish deposit, shrunk, and depressed below the surface of the surrounding tissue. The left kidney contained several larger deposits, likewise of pale yellow colour, but slightly raised above the surrounding level; the deposits occupied the greater part of the upper portion of the kidney, the corresponding arterial branch was occupied by a fibrinous plug.

This case is of interest in the marked symptoms, which led to a diagnosis of the renal affection subsequently confirmed by the *post-mortem*.

I will include another instance, for which I am indebted to the courtesy of Dr. Finlayson, of Glasgow.

Case of Renal Embolism under the care of Dr. Fraser, Paisley, and Dr. Finlayson, Glasgow.

'A married lady, aged thirty-nine, was known to have been long affected with constriction of the mitral orifice, but there was no antecedent rheumatism. She had had repeated attacks of bronchitis and other pulmonary troubles, occurring with special severity before some of her confinements; during none of these attacks had there been albuminuria, but in all of them orthopnœa was a marked symptom. During an interval of moderately good health, while she was able at least to go about her house, although easily rendered breathless, she was suddenly seized, on January 27, 1877, about five o'clock in the morning, with a slight rigor, and with breathlessness; there was generalised discomfort but no localised pain. She had slept well during the night till she awoke with the feeling of coldness. Another shivering occurred in the afternoon, and during the night there was a third shivering, associated with faintness, and a feeling "as if the heart would not work." Dr. Fraser saw her on the first day of the illness, but failed to find signs of bronchitis or any fresh mischief in the chest; the pulse, however, was irregular. He therefore ordered a sample of the urine to be kept on the following day, and it was then found to be high-coloured, loaded with urates, and rather highly albuminous; no blood-corpuscles were seen on microscopic examination, and only one or two somewhat doubtful fragments of tube-casts. On the following day, the third day of the illness, she was somewhat better, and was examined carefully in the evening. No new mischief could be detected in the chest; there was and had been a complete absence of the orthopnœa so usual in her previous illnesses; the heart's action continued to be rather irregular; no pain or tenderness existed over the kidneys; and there was no dropsy and no frequency in micturition. On inquiry as to the urine, it was reported that it had become changed for the better that very afternoon (the general symptoms having also begun to improve); by this it was meant that the urine was not so high in colour nor so thick on standing as before. The sample procured that evening was still of rather high specific gravity, and it deposited a slight sediment of urates; it gave no indication of albumen even on careful testing with nitric acid in the cold, and it gave no reaction with the guaiacum test. Under the microscope a great number of small white round cells were seen, but no red blood-corpuscles and no casts. The urine was frequently tested after this, but no albumen was again detected, and the white cells mentioned were not again seen. The symptoms may be said to have lost all severity after the third day of the illness, but the recovery of strength was slow, and it was some little time before she could move about again. The urine remained free from albumen till the fatal attack which set in with bronchial disturbance about six weeks later, and death occurred on March 26, 1877.

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[1] *Path. Trans.* vol. xvi. p. 166.

'The *post-mortem* examination was made by Dr. Joseph Coats. A yellow cheesy embolic impaction was found in the right kidney, of the usual wedge-shape, and about half a square inch in superficial area. The kidneys were normal in size. The spleen was much enlarged, and it was nearly divided by a very deep cicatrix apparently the result of an old embolism. The heart was somewhat enlarged, and the mitral orifice so small that even the tip of the finger could not enter. The curtains of the mitral valve were coalesced so as to form a funnel-shaped deformity ; on the auricular surface of the funnel, and close to the orifice, there was a fibrinous polypus adherent : it was spherical in shape, and the inside of the sphere was nearly empty (as if it had broken up), or partly filled with freshly deposited clots. The state of the other organs does not call for remark here.

'The diagnosis of renal embolism was arrived at in this case on the following grounds : 1. The existence of marked mitral stenosis. 2. The suddenness of the severe illness without any fresh pulmonary mischief. 3. The occurrence of shiverings. 4. The marked difference, especially as regards orthopnœa, between this illness and any previous attacks, a difference experienced and expressed by the patient. 5. The combination of cardiac disturbance (irregularity, faintness, &c.) with albuminuria, and the secretion of a concentrated urine loaded with urates. 6. The presence of abundant white cells in the sediment on the day the albumen had disappeared. 7. The absence of albuminuria before this illness, and the absence of albuminuria and dropsy during the very serious bronchitic attacks through which she had repeatedly passed : these facts were not consistent with the idea of mere renal congestion from cardiac disease. On the other hand, it was inferred that the renal embolism was probably not very large, from the absence of pain and tenderness over the kidneys, from the absence of blood in the urine, and from the rapidity with which the albumen and the white cells disappeared from the urine.'

The account of renal embolism would not be complete without mention of a result which is occasionally produced in the renal as well as in other arteries by embolic obstruction.

Embolic aneurism.

Apparently chiefly in consequence of the hurt inflicted upon the vessel by the lodgment, aneurism in the place of it has been known to occur in the arteries of the brain, of the limbs, of the lungs, of the heart, and of the kidneys. The following case is an example of the latter rare condition :—

Extravasation of Blood into the Kidney, probably from the bursting of an Aneurism consequent upon Embolic Obstruction.

William Stowe, twenty-six years of age, a blacksmith, came into St. George's Hospital, January 2, 1867, under the care of Dr. Ogle. He was suffering from an aggravation of old valvular disease of the heart, the result of rheumatic fever. There was a loud murmur, and much disturbance of cardiac action. He had much pain, increased by pressure over the region of the left[1] kidney. No previous symptoms of renal disease had been recognised, but the urine, which was clear, and had a specific gravity of 1014, contained albumen, and showed under the microscope crystals of hæmatin. There was a patch of ecchymosis upon the left arm, with a swelling which was thought to be due to an extravasation of blood into the muscle. On the day after admission he died suddenly.

The *post-mortem* examination, which was made by Mr. Pick, brought into view the following changes:—

The aortic valves were thickened by not very recent deposit. The right kidney was coarse and congested. Blood had been largely extravasated beneath the capsule and into the substance of the organ near the entrance of the vessels. There were also found in the organ two old fibrinous blocks of small size.

The left kidney was natural.

The swelling in the arm was produced by a recent extravasation, in the neighbourhood of which were two small aneurisms on branches of the brachial artery.

The pericardium contained a quantity of blood, which had its source in one of three small aneurisms which were in connection with superficial branches of the coronary artery.

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[1] This is probably a clerical error for *right*. I have preferred, however, to leave the statement as it occurs in the notes of the case.

From the finding of aneurisms in connection with both brachial and pericardial hæmorrhages it may be looked upon as certain that the renal hæmorrhage had also an aneurismal source. Neither is it possible to doubt that the arterial dilatations had their origin in embolic obstruction. That embolism had occurred was proved by the blocks in the kidney.

The coats of the arteries were generally natural, so that no results could be attributed to disease primary to them; while the minuteness and multiplicity of the vessels affected are characteristic of the embolic origin.

Treatment.

With regard to the treatment of embolic obstruction of the renal vessels little need be said. The question resolves itself into the larger inquiry, the treatment of cardiac disease. Generally speaking, the results of embolism in the kidney are not serious or lasting. The block is rapidly disintegrated and absorbed, and its place knows it no more. When, as sometimes happens, severe pain results from the impaction, opiates, by injection or otherwise, may be resorted to; beyond this the treatment of the affection may be left to the secret workmanship of nature.

CHAPTER V.

GENERAL RELATIONS OF RENAL TUMOURS.

THE subject may be conveniently taken in two parts, the first dealing with the general relations of renal enlargements, whatever be their nature; the second with morbid formations, whether attended or not with obvious tumefaction.

Frequent subjects of erroneous diagnosis.

Swellings of the kidney are perhaps more often the subjects of errors of diagnosis than those of any other organ, which as frequently presents itself in the guise of an abdominal tumour. Doubtful tumours are apt to present the riddle of their nature in the shape of the question, 'Is it renal or is it not?' This answered, the rest is clear. To suppose a solid renal tumour to be splenic, or a hollow one to be ovarian, are errors of not infrequent occurrence; while a list of the enlargements which have either been erroneously supposed to be renal, or for which renal swellings have been mistaken, would be little short of a complete catalogue of abdominal tumours. It would include tumours in connection with the liver and with the uterus; enlargements of the supra-renal bodies, of the lumbar glands, and of the mesenteric glands; intestinal accumulations, abscesses, especially such as are in connection with the vertebræ, and, strange to say, ascites, for which not only have renal cysts been mistaken, but even solid tumours. In a child three years of age a fluctuating renal sarcoma was thus misinterpreted.[1]

The marks whereby renal tumours are to be recog-

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[1] *St. George's Hospital Museum Catalogue*, Series xi. Prep. 38.

Anatomical relations.

nised are mainly anatomical. It is not necessary to say that the kidneys extend from the front of the eleventh rib to near the crest of the ilium, the right coming a trifle lower down than the left. They are supported behind by the flat muscles of the abdominal wall, which are themselves backed up by the great erectors of the spine, and their attachments to the lumbar vertebræ. In front they are separated only by the peritoneum, and partially by the large bowel, from the abdominal cavity, so that, should they become the subjects of swelling, their bulk will probably come forwards as the direction of least resistance. It is only in exceptional circumstances that a renal tumour obtrudes in the loin as more than an indistinct fulness; this, indeed, may be the only backward manifestation of a swelling which may fill a considerable portion of the abdominal cavity. But, however apt to encroach upon this cavity and confuse themselves with the organs which lie within it, there are certain characteristics which cleave to them as post-peritoneal. One is the direction of such diseases as, like cancer and abscess, advance by contiguity from the kidney to the other organs placed with it behind the serous partition. We see this in the invasion of the vertebræ by adjacent renal cancer, and in the erosion and possible penetration of the vertebral column by pus of renal origin. In the next place renal tumours so seldom fail to have bowel in front that the exceptions have the interest of *lusus naturæ*.

Consequent characteristics.

Situation of bowels in regard to renal tumours.

To state the rule before the exceptions, the ascending colon usually is to be found in front and towards the inner side of a right renal tumour, the descending colon in front of one belonging to the left side; besides which tumours of either kidney are apt to have coils of small bowel before them, overlying especially their inner half, unless they have attained such dimensions as to be widely in contact with the abdominal wall.

The position of the duodenum in front of the right kidney would lead one to expect that it would still be in front of a renal tumour. It does not appear, however, to be carried straight forward. In Dr. Hillier's case of right hydronephrosis referred to at p. 832, this portion of the intestine was adherent to the upper and left side of the cyst; and in an instance of tubercular enlargement of the right kidney recently under my care the duodenum was found (see fig., p. 809) after death closely adherent to the inner side of the organ, while the ascending colon traversed its front. I may refer also, with regard to the relation of the duodenum to renal tumours, to a case of sarcoma related and illustrated at p. 714.

But so pertinaciously does the colon on each side hold to its position as to be almost never absent from the front of a renal tumour, and can be here recognised, even when flattened and non-resonant, by the sensation which it gives as it rolls under the fingers. Bowel is never found in front of an enlarged spleen, and seldom before an enlarged liver. With regard to liver, the rule is that under enlargement the front edge falls like a shutter immediately behind the wall of the belly, without intervening intestine; but exception to this rule may occur when either the shape of the liver is much altered by disease or the abdominal wall much protruded by ascites. The two causes may concur, and bowel be abundantly resonant in front of a hepatic tumour, when the liver, as with hypertrophic cirrhosis, is made globular at the same time that it is increased in bulk, so that as it passes downwards it slopes away from the abdominal wall, and also sometimes when cancerous masses protrude from its under surface.

Exceptions to ordinary positions of bowels.

The rule that a renal tumour has bowel before it is not, as has been implied, without exception. The colon on the right side is not so closely connected with the kidney as on the left, and a renal growth has been known to insinuate itself between the liver and ascending colon, and to push the latter down instead of carrying it in front (as in a case at p. 718, for which I am indebted to Dr. Bridges).

Again, a renal tumour, if very large, may carry the bowel with it in its advance towards and beyond the median line, so that the colon, though still in front of the tumour, is not on its own side of the body. (This point is illustrated at p. 714.) Another exception may be with a floating kidney, as it is called, or a kidney which enjoys the liberty of a mesentery. This may be uncovered by bowel of any kind, and lie immediately under the surface, like a fæcal accumulation, for which indeed a healthy floating kidney may be easily mistaken. A floating kidney may become the seat of tumour, or, perhaps, more often a diseased kidney may float. A patient underwent an operation in the Middlesex Hospital for the removal of a tumour, which was thought to be ovarian. It bulged forwards below the umbilicus, on the left of the median line, and could be felt also in the left lumbar region, which was dull on percussion, as compared with the other side. The uterus was in its natural position, and freely movable, independently of the tumour. The renal origin of the disease was first suggested in the course of the operation, when it was discovered that, though not closely bound to the lumbar region, the mass was covered by peritoneum in such a manner as to forbid its excision. After death it was found that the growth belonged to the left kidney, though it had sprung from the cellular tissue of the hilum rather than from the glandular substance. It had, like many other renal tumours, an encephaloid appearance and a sarcomatous structure. The peculiarity of the case, and probably the source of error, was in the situation of the tumour wholly in front of the bowel. The kidney, together with the growth within its capsule, was loosely tethered to the renal position by a 'mesentery,' which permitted the mass to come so far forward that the descending colon and sigmoid flexure, with the rest of the bowels, lay behind it. Looking at the case with posthumous wisdom, it is easy to say that the natural position and mobility of the uterus, together with the large amount of lumbar dulness for the size of the tumour, had it been ovarian—it was about four inches in diameter—might have raised doubt as to its ovarian nature.[1]

May be confined to one side or occupy both.

Renal swellings, when small, are usually confined to their own side; when large they encroach upon the other; when very large they appear to fill both, but seldom so equally but that with care a distinction can be discerned. When the kidney is distended with liquid, as in hydronephrosis, it may occupy the whole belly; or, short of this, much of its bulk may cross the median line as if it were ovarian, which in many instances it has been supposed to be; it has even passed as ascites, and that in careful and practised hands. A collection of pus within the renal cavity may transgress the median line, as in a case under my own observation in which the outline as felt during life is shown at page 710.

Even a solid renal growth may be of such a size compared to the abdomen as to occupy the greater part of it with little distinction of side, as in an instance already alluded to, in which a fluctuating renal sarcoma was mistaken for ascites. The growth was from the concavity of the kidney, so that its line of advance was towards the vertebral column and the opposite side.[2] (*See* also case related and illustrated at page 714.) And where a solid renal tumour has been relatively smaller, I have known some part of it, or of the parent organ—the lower end of the latter in particular—to be thrust downwards and forwards, so as to infringe upon the abdominal wall not only much below its proper position, but across the median line.

The accompanying outlines, together with those at pages 714, 718, 808, and 809, will show the positions in which renal enlargements usually manifest themselves. While small, they are evident only on deep pressure, and in the proper renal position. Sir William Jenner long ago told us how to estimate the size of the kidney by

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[1] *Lancet*, March 18, 1865.

[2] See Prep. in *St. George's Hospital Museum*, Series xi. Prep 38.

General position of renal swellings best detected by touch.

touch, a more sure mode than percussion.[1] One hand is to be placed behind the patient underneath the last rib and just outside the great lumbar muscles, the other in front just over the hand behind, if in the right side immediately under the liver; thus the kidney lies between the two sets of fingers, and by diverting the patient's attention so as to secure abdominal relaxation, and by taking advantage of the act of expiration, the bulk of the organ may be appreciated in a thin person, even when not greatly increased. Sometimes in children the healthy kidneys may be felt by this means; but as a rule a palpable kidney is a diseased kidney, more especially when only on one side. In three cases recently under my care a comparatively small alteration in the size or prominence of one kidney was appreciated by touch during life, and the observation subsequently verified. In one the organ was lifted by a spinal abscess behind it; in another it was stretched, but not excessively, as the result of an urethral obstruction; in the third it was surrounded by adhesions and increased in rotundity, though not in absolute bulk, as consequences of tubercular disease. Renal tumours are indeed often appreciable by touch which are not to be detected by any other means.

Presentation of renal tumours.

As such tumours increase they approach the front wall of the abdomen, usually at about the level of the umbilicus, perhaps a couple of inches on one side. The 'presentation' of a renal tumour is, however, various. With enlargement it fills up the lateral space between the edge of the thorax and the spine of the ilium, and causes that region to impart a sense of fulness or resistance, and in some cases to bulge, to the loss of bilateral symmetry. The fulness passes towards the backbone, and is to be traced as far as the great lumbar muscles will allow. No interval, either of increased resonance or diminished resistance, is to be made out between these muscles and the renal mass: important as a means of distinguishing renal

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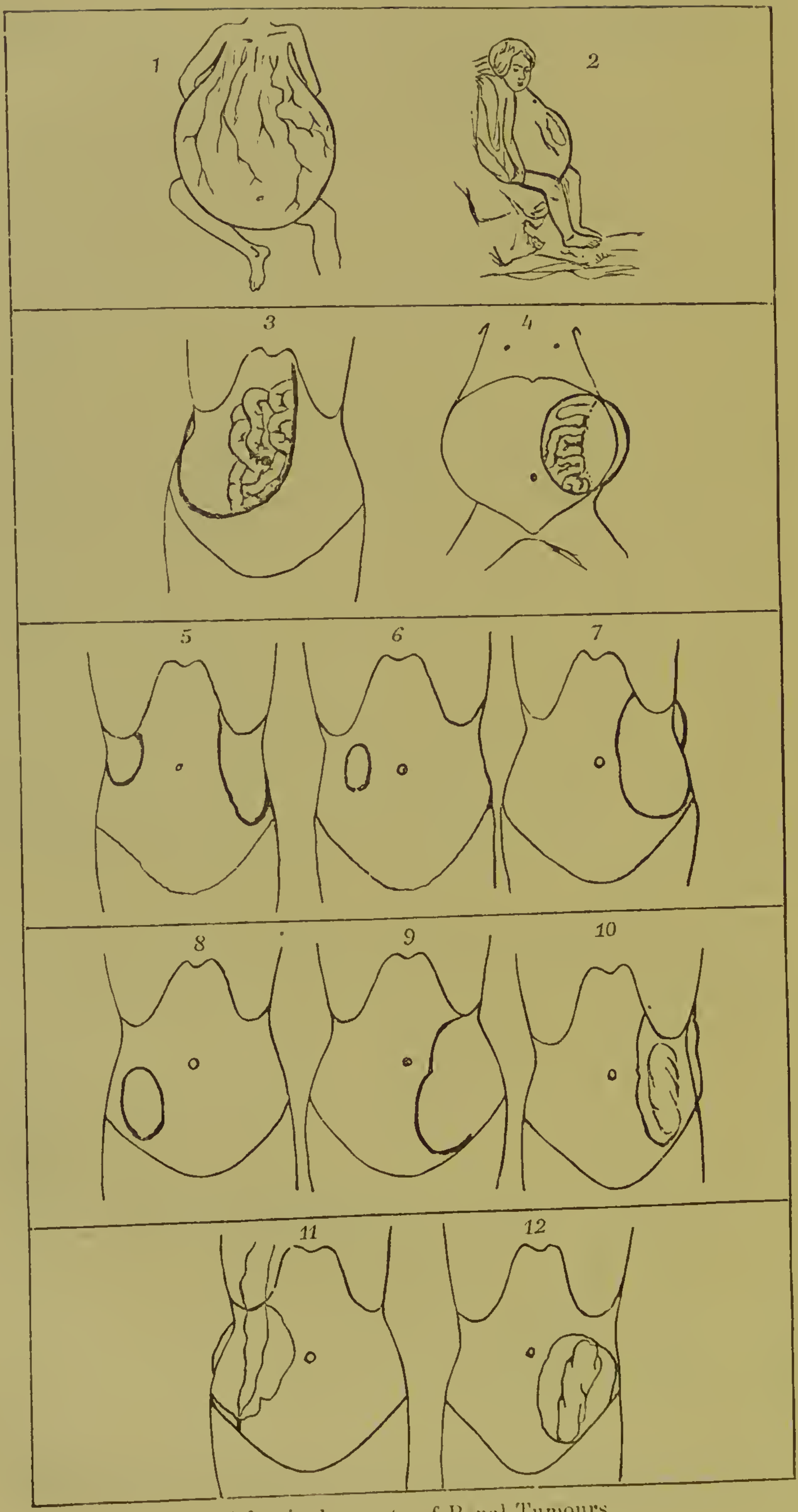
[1] 'Lectures on Extra-pelvic Tumours of the Abdomen,' *Brit. Med. Journ.* 1869 (Jan. 16), p. 42.



Abdominal aspects of Renal Tumours.

1.—Encephaloid of left kidney in a boy six years of age. Weight of tumour 31 pounds. (Dr. Hawkins, quoted by Roberts.)

2.—Renal encephaloid in a girl four years old. Weight of tumour over 16 pounds. (Spencer Wells, 'Dublin Quarterly,' 1867, p. 129.)

3.—Distension of right kidney by pus, the result of stone. The position of bowel resonance before the tumour, as observed during life, is shown. After death the cæcum and ascending colon were inseparably adherent to the front of the tumour, beside which it was overlapped by small bowel. From a young woman under my own care.

4.—Girl one year and eight months old, under my own care. Globular tumour projecting lateral aspect of trunk. Bowels felt and percussed over inner half. Sarcoma of kidney diagnosed and shortly afterwards discovered. The descending colon lay close to median line along inner edge of tumour.

5.—Cystic kidneys.

6.—Suppurating kidney.

7.—Distension by pus.

8.—Enlargement of right kidney, pus being discharged with the urine.

9.—Dilatation of kidney dependent on obstruction by a calculous tumour descending towards pelvis as if uterine or ovarian.

10.—Suppurating kidney showing position of descending colon.

11.—Fungoid tumour of right kidney erroneously supposed to be connected with the concave surface of the liver. Situation of large veins marked.

12.—Fungoid (malignant) tumour of kidney apparently divided into two by descending colon.[1]

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[1] Figs. 5 to 12 are copied from Bright's 'Abdominal Tumours.'

from splenic tumours. When of large size, renal tumours may bulge laterally, but they seldom do so posteriorly, their presence being indicated here rather by the effacement of hollows—'levelling up.' It has been laid down that such tumours never protrude posteriorly, but the rule is not without exception. A pulsating renal growth in St. George's Hospital declared itself by a swelling over the right side of the sacrum.[1]

Their persistency of shape.

Renal tumours, whether solid growths or fluid accumulations, are apt to retain much of the original shape of the organ—sometimes, indeed, almost its exact shape—notwithstanding great increase of size. There are, of course, exceptions to this rule, where growths are not distributed through the gland, but sprout from a single spot, as from a part of the pelvic areolar tissue. But there are few exceptions to the rule that the kidney, normally rounded as it is in every direction, never acquires a sharp edge. The kidney 'is rounded,' says Jenner, 'on every side, and in disease never loses this peculiarity.' This point may often be sufficient to determine the distinction between a renal enlargement and one belonging on the one side to the liver, or on the other to the spleen.

Generally, but not always, immobile.

No certain inference is to be drawn from the fact that a tumour descends with inspiration. Hepatic and splenic growths do so; the latter conspicuously. A renal growth or dilatation is commonly fixed posteriorly, but it may bend upon itself so that its fore part will move with the diaphragm. I have two patients at the present time with pyelitis and renal dilatation; in both the upper and fore part of the mass markedly descends with inspiration. In both it is on the right side, so that it moves with the liver, though distinctly separable at least from its anterior part.

Tumours of the kidney, if large, may compress the vena cava, and cause as much exaggeration of the superficial abdominal veins as is produced by portal obstruction;

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[1] Related by Mr. T. Holmes, *Path. Trans.* vol. xxiv. p. 149.

this appearance is therefore of little diagnostic significance.

The following cases illustrate some of the points which have been referred to in regard to the abdominal relations of renal tumours.

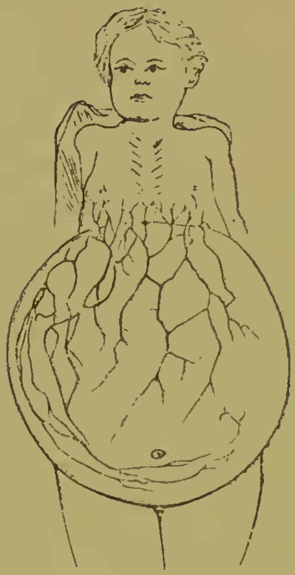
Large Renal Sarcoma, in a child three years of age.

Lily Langley, a child of the age of two years and eleven months, was admitted under my care at the Hospital for Sick Children on March 4, 1882. She had been apparently well until two months before, when the belly was noticed to be swollen. The child did not seem otherwise out of health until five weeks before admission, when she caught cold and had bronchitis, which laid her up for a fortnight. During this time she had 'stomach-ache' which lasted for a day and a night.

On admission she had a large rounded swelling of the belly which was without difficulty diagnosed as the result of a renal sarcoma. The belly measured on admission 26½ inches in circumference at the level of three inches above the navel; the measurement in this position, where it was at its greatest, gradually increased, until by March 28 it had reached 31½ inches, which was the greatest girth attained. After this the wasting of the body, together perhaps with some partial shrinking of the tumour, more than counterbalanced its further growth, so that by April 25, the last day on which measurements were made, the circumference had lessened by a quarter of an inch. The distance from the ensiform cartilage to the navel was 8½ inches; from the navel to the symphysis 4 inches.

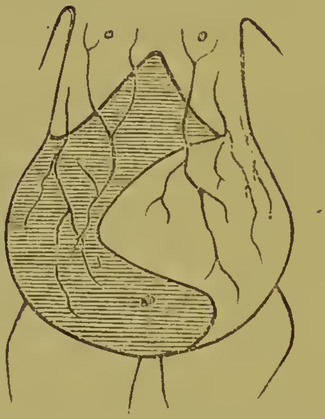
The abdominal swelling roughly resembled that of pregnancy, if the comparison may be applied to so young a subject, though it was proportionally greater than ever proceeds from this cause. The appearance is well represented in fig. 1, which is taken from a sketch by Dr. Westmacott. By handling and percussion it was found that though the swelling was nearly symmetrical, the tumour was not so. The right side of the abdomen, and part of the left side, in the hypochondriac and lumbar regions, the whole of the right lateral and lumbar regions, were dull on percussion, the hardness of the tumour being appreciable to the fingers immediately beneath the abdominal wall without intervening bowel. Fig. 2 shows where the tumour was superficial, as ascertained by touch and percussion. The mass stretching in continuity with the tumour across the epigastric region into the

FIG. 1.



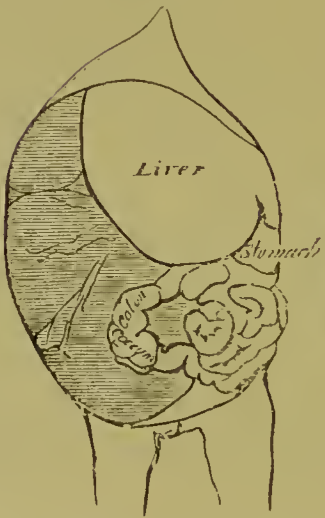
General aspect.
March 10.

FIG. 2.



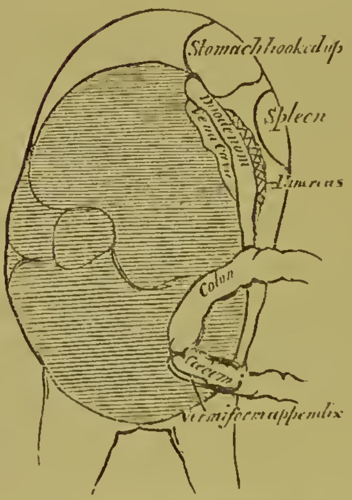
Position of dulness, together with superficial resistance and bowel resonance. Shading = dulness. March 10.

FIG. 3.



P.M. Position of tumour upon opening abdomen. Shading = tumour.

FIG. 4.



Relations of tumour as seen after removal of liver and small bowel.

left hypochondrium had a sharp lower edge and felt like what it ultimately proved to be, the liver displaced. Between this and the umbilicus, where no shading is, was a space of superficial bowel resonance, beyond the greater part of which the tumour could be deeply felt. This clearly indicated the position of intestine overlying its left and central region, though the greater part of the mass was absolutely superficial. The outline No. 2 was taken on March 10. After this date the inlet of resonance gradually diminished in every direction, so that before death there was but a small narrow tract where bowel could be recognised, wholly and considerably to the left of the umbilicus. The complete displacement of bowel from its usual position is a point of interest. I may add its absence, as indicated in the diagram, was verified by inflation per anum. The swelling could be traced without the interruption either of resonance or softness into the right lumbar region, which was slightly bulged.

The belly and adjacent part of the thorax were covered with distended veins. The child had to be propped upright in bed, as she could not breathe comfortably in any other position; but otherwise she was remarkably free from pain or distress. She had occasional attacks of epistaxis. While in the hospital she caught scarlatina, and passed through its course as smoothly as any previously sound child could have done.

After this a little albumen was found in the urine, which had hitherto been natural, and the legs became slightly œdematous, which they remained. She continued gradually to lose flesh; and at last, after an attack of vomiting, fell into a state of painless prostration, in which she died on May 5.

The temperature for the first fortnight ranged between 97° and 99°, for the most part being between 98° and 99°. It afterwards became more irregular, rising at intervals to 101° or 102°. During the last three days it varied little from 101°.

On opening the body it was at once seen that the liver was pushed into the left hypochondrium, the tumour lying to its right and underneath it, presenting itself immediately beneath the abdominal wall from the ribs to the pelvis, covered on the left by the large and small bowel, as represented in fig. 3. The outlines in figs. 3 and 4 were traced from the body on glass, and then reduced by photography, so that they may be taken as accurate, however rough. Upon removing the liver and small bowel the tumour was exposed as in fig. 4. The upper part was in contact with the diaphragm, the lower overhung the pelvis. The cæcum and ascending colon remained fixed to its anterior surface to the left of the median line. The duodenum, vena cava, and pancreas lay along the left edge of the tumour in the right hypochondrium; beneath the pancreas was the left supra-renal capsule. Compressed and deflected as the vena cava was, it is difficult to realise that the circulation should have been conducted with so little hindrance as had been the case. The aorta lay behind the left edge of the tumour at a distance of two or three inches from the vena cava.

The mass had somewhat the shape of the natural kidney. It weighed, with the right kidney attached, 11 lbs. 10 oz.; the rest of the body weighed 21 lbs. The body unopened had been found to weigh 35 lbs. On section the tumour consisted of a soft spongy mass of new growth, which contained in places shreddy masses of coagulum and in other parts was hollowed into cavities which contained clear yellow highly albuminous fluid. No remnant of natural kidney-structure was visible to the naked eye. Sections made from many parts and examined with the microscope showed the structure of a small round-celled alveolar sarcoma. Traces of the proper structure of the kidney remained in many places, so that its relation to the growth could be discerned. The minute round cells which were the essential part of the growth could be traced in some places in inseparable relation with the interstitial tissue. In many parts were round alveoli filled with somewhat irregular small cells, which, had they been regarded separately, would have been with difficulty distinguishable from those of carcinoma. The liver was flattened and extended by compression; no new growth was found excepting in the tumour; the mesenteric glands were congested and swollen, but not otherwise diseased, nor were any of the absorbent glands distinctly the seat of malignant disease.

The case is of interest in showing the complete displacement of the bowel, including the cæcum and ascending colon, to the left of the median line, and also in the minute structure of the growth, which, though, as would now be called, sarcoma, was so nearly allied to carcinoma in its alveolar structure as to leave little definite distinction between the two forms of growth.

For the following case in illustration of some of the points referred to in this chapter I am indebted to my former colleague, Dr. Bridges.

Case of malignant disease of the right kidney, in a child of five years, in which the transverse colon was below the tumour, and not in front of it.

'Arthur Wynne, aged five years, a pale, emaciated, fair boy, with fat cheeks, admitted into Hope Ward, St. Bartholomew's Hospital, under Dr. Black, on February 19, 1876, for a tumour in the side, which was stated to have been first noticed about Christmas, 1875. Patient has a cough, which has existed for twelve months; he has been thirsty and restless but not sick. He is the second of three children—one "died of a pleurisy" in the left side, the other has been healthy.

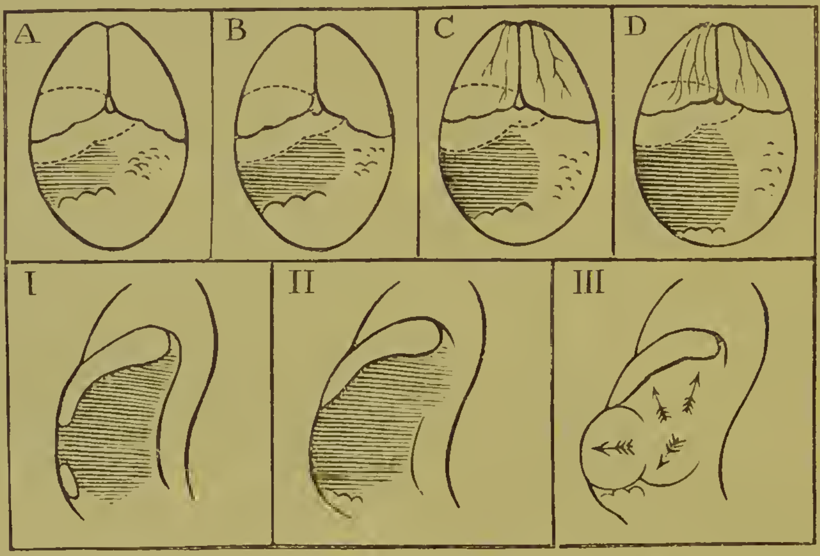
'There was a large tumour in the right hypochondrium, reaching as far down as the umbilicus, pushing forward the ribs, and filling out the right loin. The liver-dulness was absolute, and increased upwards; while below it was continuous with the absolute dulness of the tumour. The intestine came forward over its lower part.

'Heart natural, action irregular, some moist sounds in the right lung. Body-heat about 1° Fahr. above normal. Pulse about 120°, very irregular. Urine scanty, about three-quarters of a pint in twenty-four hours, and full of urates (these remained constant); a slight cloud of albumen, and a great quantity of phosphates (these varied); under the microscope pus-cells were seen, but there was no pus-reaction with potash, and the albumen when present seemed to be independent of the pus. No anasarca, no distension of veins, no jaundice.

'The patient up to within a day or two of his death had a good appetite, and was free from any renal symptom beyond those mentioned above. The tumour, which was painful when it had been handled, was rather tender, otherwise not painful. It gradually increased in size and became more painful. The child slept well, however, but lost all colour, and dyspnœa increased. As the circulation was interfered with, a slight anasarca of the legs showed itself (there was never any of the face or arms), and the anastomotic circulation came out on the chest, the veins running from the hypogastric region to the vena innominata being greatly enlarged at the time of death. There was nothing corresponding to this on the surface of the abdomen. The patient died, on May 8, of exhaustion.

'After the first examination of the patient an opinion was given that the tumour was a malignant right kidney which had displaced the liver; and as this conception of the position of the abdominal organs was shown by the *post-mortem* examination to have been correct, the following remarks are of interest. In the diagrams nothing is depicted that might not be easily felt or percussed during life.

'The most prominent part of the tumour on admission, and for some time after, was in the situation of the left half of the right lobe of the displaced liver, which bulged out below the ribs. Below this the edge of the liver was felt, and immediately below this line the tumour was softer, and gave a sense of fluctuation to the hand, so that it was twice punctured thereabouts in the hope of relieving the distension; and it was in this situation that the greatest prominence subsequently grew, and distended the skin so much near the navel that it seemed as if the diseased mass would make its way out externally. The skin was inflamed over the greatest prominence subsequently in two places, but afterwards the inflammation receded.



Diagrams illustrating Dr. Bridges' case of malignant disease of the kidney. A B C and D represent the progressive growth of the tumour as seen from the front; in the shaded part the growth was superficial, the bowel lying at its lower edge as represented by the curved line. I, II, and III show the progress of the tumour as imagined in section. The intestine is indicated, as before, at its lower edge.

'The growth of the tumour, as it could be observed from without, was at first downwards—that is, it did not seem to grow up out of the pelvis or loin, and displace the liver late in its course. The displacement of the liver was complete when first observed. The region below the umbilicus was invaded late, and the pelvis was never filled with the tumour. After death the ascending and transverse colon were in the pelvis. The colon was never in front of the tumour. As observed from without, the upper part of the tumour was always continuous with the liver, and the lower part sloped away into the hollow of the abdomen. Over this shoulder or slope of the tumour the colon, in the earlier weeks, might be percussed and felt, and moved away downwards by pressure from above; but as the tumour grew forwards (subsequently described), the colon entirely disappeared, which was explained by the *post-mortem* observation of its position.

'This growing forwards of the tumour did not happen till quite the end: it seemed as if the tumour had filled all the available space in the abdomen, and was now distending the wall in its weakest part. There seems very little doubt that the tumour began to grow upwards from the kidney, and that it tilted the liver forwards by wedging it from the spine, and dislocating the portal vessels. This is the only way of accounting for the position of the liver, which was carried on the front surface of the tumour like a pad interposed between it and the ribs. Subsequently, as stated, the tumour grew forwards, as if at right angles to its previous direction. It entirely excluded the colon in this way from any contact with its front, and after death the whole tumour had the appearance of two ovoid ones, one smaller one set on the other. The patient was daily observed, and there was no shifting of the tumour.'

The following is the report of the *post-mortem* examination:—

'Belly much swollen on right side. The tumour crosses the middle line, the legs anasarcous. The right pleura holds a little fluid, not in excess. The lower lobe of the lung collapsed. Growing on the pleura is a cancerous mass, almost as large as the lung itself, very pulpy, of a pale pink colour, sown with hæmorrhage. This can be easily probed off the pleura of the lower lobe, except a place about the size of a shilling, to which it is firmly attached; here the pleura is destroyed, and a small cancerous nodule is growing into the lung. At apex of left lung a cancerous nodule the size of a walnut. Heart natural.

In belly there is a large tumour on right side, pushing forwards and upwards the liver. The lower surface of the liver is closely adherent to the tumour, and it can with some trouble be cleanly dissected off from it. The liver itself shows a few white nodules dispersed through its substance, otherwise tissue quite natural. The spleen is natural. Stomach and intestines natural. The vena cava passes over the fore part of the tumour; almost as soon as it is formed it is greatly pressed upon, and contains a thrombus on its back wall. It receives about its midst the renal vein from the great tumour; the right iliac vein is completely filled by a thrombus. The ureter enters the mass, ureter being apparently quite natural. The tumour weighs 3,700 gram. It still retains roughly the shape of the kidney. It is closely adherent to the diaphragm above, and passes into the false pelvis below. No trace of supra-renal capsule can be made out. On section the tumour is made up of very white soft cancer in which large masses of extravasated blood are enclosed. No trace of natural kidney-substance can be found.

'The left kidney and capsule seem natural. One part of the kidney cortex shows a white confused appearance, as if cancer were beginning to grow in it.'

Urine often unaltered.

Urinary changes have only a secondary place in the diagnosis of renal tumours. Blood or pus in the urine, together with signs of renal enlargement, may be conclusive as to the nature of the disease; but it often happens that, if the enlargement be solid, the growth is external to the pelvis, and exerts no appreciable influence upon the urine, and generally if it be by fluid accumulation that the exit of the kidney is closed, either permanently or with only occasional escape, so that the urine which comes under examination is entirely secreted by the healthy organ.

Renal tumours distinguished from those of

It may be of use to epitomise the distinctions by which tumours of the kidney may be distinguished from each of the forms of swelling with which they are liable to be confused.

Liver;

First as to the liver. Tumours of this organ are continuous downwards from the hypochondrium, while those of the kidney are usually separated by softness or resonance from the hepatic position. With enlargements of the liver an acute margin can generally be traced. It is only in exceptional circumstances that bowel is to be discerned before an enlarged liver. The difficulty sometimes experienced in distinguishing renal from hepatic cancer is illustrated in connection with diabetes insipidus by a case related at page 224.

Spleen;

Splenic swelling, when so small as to be just within touch, may be behind the bowels, and so far like one of renal origin; but it will be traceable upwards to beneath the ribs as a renal tumour of that size would not be. A splenic tumour of considerable size is easily distinguishable by the absence of bowel in front, by its sharp outline, its notch, and by the existence of resonance or softness between itself and the spinal region. Further, a splenic tumour is movable; though a displaced healthy kidney may move freely, an enlarged and diseased kidney is usually fixed. Finally, unilateral bulging may suggest that the cause is not splenic but is connected either with the kidney or with some other extra-peritoneal structure.

Ovary;

The distinction between renal and ovarian tumours is of large practical importance. The position of the bowels is the chief guide. Renal tumours almost invariably have intestine in front; ovarian tumours as a rule do not. Ovarian tumours as a rule push the intestines aside as they come forward and abut without interception against the abdominal wall. This rule is unfortunately not quite without exception, as coils of bowel have occasionally become fixed by adhesions to the front of an ovarian tumour, and have even been perforated in this situation by a trocar. Thus the presence of bowel in front does not absolutely disprove the ovarian origin of an abdominal tumour, any more than its absence absolutely disproves its renal source; but the indication thence derived is of general value. To determine the absence of bowel the absence of resonance is not enough; the rolling of empty bowel must be sought for by slipping the integument with the fingers; and, if necessary, the bowel may be inflated per anum—a measure of the more effect as the intestine to be expected is colon. Ovarian tumours are usually more globular than renal, and more central. Further, a distinction may be made by vaginal examination: if the tumour be felt within the pelvis it is probably not renal, nor is it if the uterus be much lifted. A large renal tumour depresses the uterus. Further difference may be found in the fact that ovarian cysts are often multilocular; renal cysts of such size as be prominent as abdominal tumours are generally unilocular, except they be hydatids, produced as they are by simple exaggeration of the normal cavity of the kidney.

Peritoneum;

The absence of albumen and the presence of urea in the fluid contained would probably be conclusive of a renal cyst whether the alternative were ovarian dropsy or ascites. With regard to the latter condition, in Dr. Hillier's case, where for a time hydronephrosis was thus interpreted, the diagnosis was finally limited to that of renal cyst by the nature of the fluid withdrawn: this was essentially urine, it contained at one time no albumen, but urea and uric acid. Other points of distinction between ascites and hydronephrosis may be found in those of ordinary application in the distinction of encysted and peritoneal dropsy, and in the tracing of the swelling of hydronephrosis into one lumbar region with greater bulging on that side than on the other.

Supra-renal bodies;

As to the supra-renal bodies, it would seem strange that growths here arising should be distinguishably different in their relations from those of the kidneys with which they are in contact; but these bodies, though placed behind the large bowel, are not overlaid by it in the same direct manner as are the kidneys, and though I have but a single case to appeal to, yet it enables me to say at least that supra-renal tumours are not necessarily crossed by bowel as renal tumours almost invariably are. The only instance I know, in which a supra-renal tumour had attained sufficient dimensions to present itself during life as an abdominal tumour, occurred in St. George's Hospital, when I had charge of the *post-mortem* department. A girl three years of age presented in the left hypochrondriac region a hard, round, slightly movable mass, of which the whole circumference could be traced. The skin was generally hyperæmic; it was gipsy-coloured, though not bronzed, and was covered with a remarkable growth of dark hair. The tumour proved to be a globular mass of encephaloid, six inches in diameter, which had replaced the left supra-renal capsule. This lay immediately beneath the abdominal wall, uncovered by bowel of any kind. It had pushed itself out of its proper place in regard to the kidney, and lay along its inner edge close to the hilum, which, with the tumour upon it, was turned forward, the growth extending without interruption between the concave margin of the kidney and the abdominal front. Thus the tumour had assumed the position but not the relations of a renal enlargement.[1]

Absorbent glands;

Tumours which spring from some of the absorbent glands, whether lumbar or mesenteric, in the immediate neighbourhood of the kidney, may be indistinguishable from those belonging to that organ. The annexed outlines refer to a case of encephaloid disease of the lumbar glands which had most of the renal characters. The mass, part of which was the healthy kidney and part a mass of cancer which had started in the lumbar glands, was crossed by the descending colon nearly in the position of the line in the second diagram which limits the palpation area. As is apt to occur with renal cancer, the lumbar vertebræ had been invaded and paraplegia produced. In this case it was believed until death that the tumour was renal, and it is not easy, even in the light of the *post-mortem*, to see how a distinction could have been made.

In another case, also of a child, I met with more success. The tumour, like the preceding, belonged to the lumbar glands; in position and relation it was not to be distinguished from a renal tumour, save that a protrusion from it entered the scrotum, a circumstance which suggested its origin in the lumbar region in relation, not with the kidney, but with the testicle. A character which

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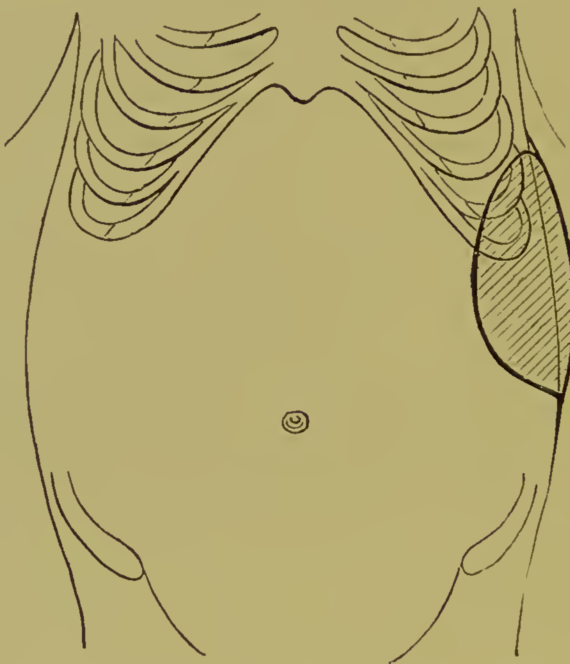
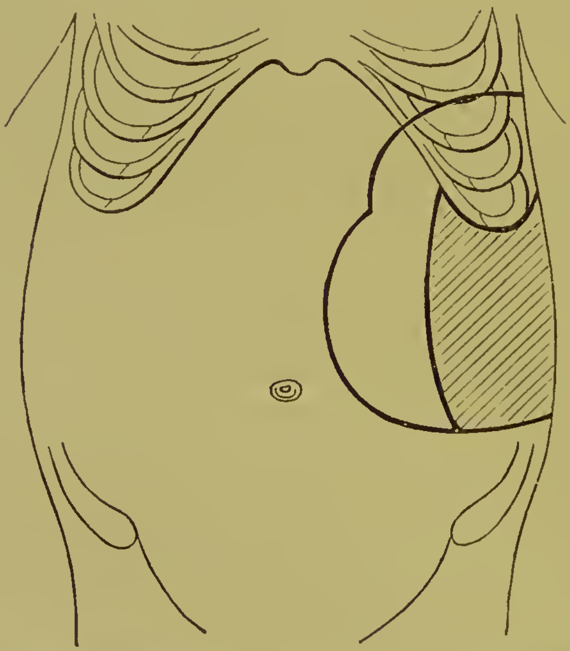
[1] The child was under the care of Dr. Pitman, in St. George's Hospital, in the year 1864. The *post-mortem* examination was made by myself. The preparation is in the museum of the hospital, series x. prep. 51. It is described by Dr. John Ogle in the *Path. Trans.* vol. xvi. p. 250.



Encephaloid of Lumbar Glands simulating a renal tumour, as it appeared in March.

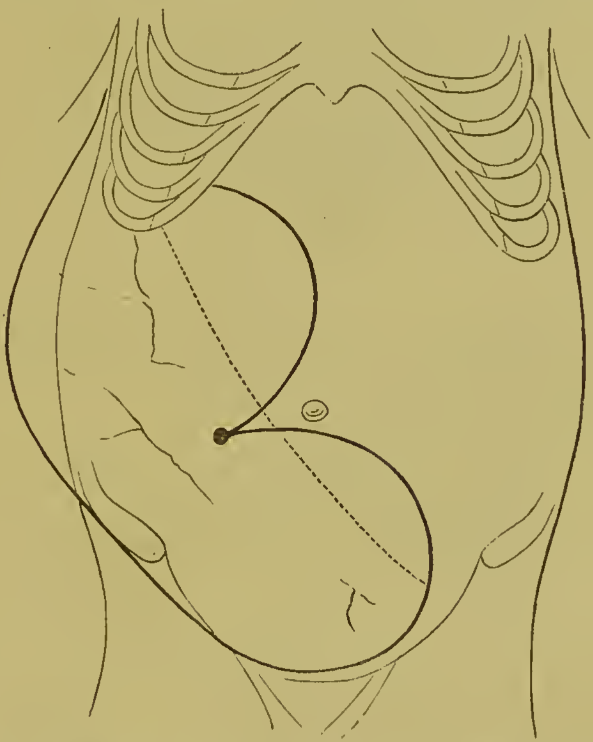


Same tumour, as it appeared in the following August. Shading = palpable tumour. Outer line = dulness.

helped to guide the diagnosis in this case, and of which I have seen the value in others, is the more marked or abrupt prominence of the swelling than is usual with renal tumours.

The growth consisted of fibroid and adenoid tissue, together with many cystiform cavities.

In a third instance within my own experience, of a glandular simulating a renal tumour, its origin was in one of the mesenteric glands.[1] The relations of the tumour, as made out during life and displayed after death, are represented in the outlines on pages 726 and 727. The subject was a child two years of age; the tumour was highly compound in its nature, containing fibroid tissue, fat, cartilage, bone, and muciform fluid.



Adenoid cystic tumour of lumbar glands, which descended into scrotum, but otherwise simulated a renal tumour, as seen during life. The cysts are full and tense. The dotted line shows the extent of dulness. (See woodcut on next page.)

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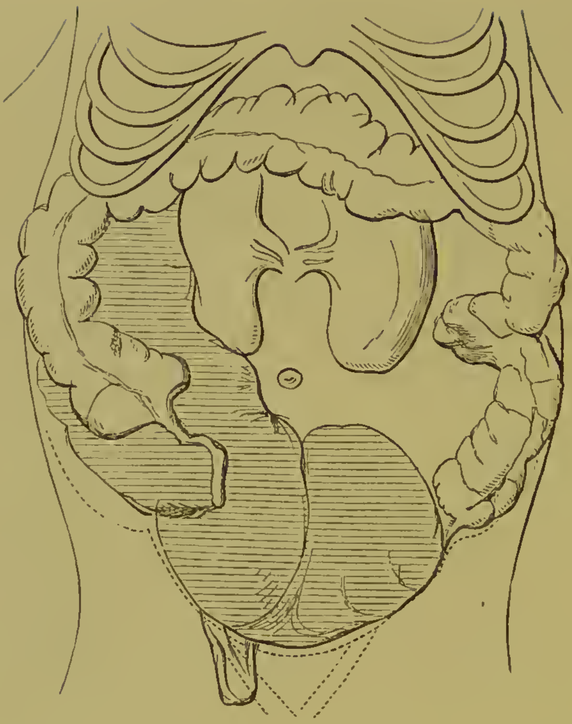
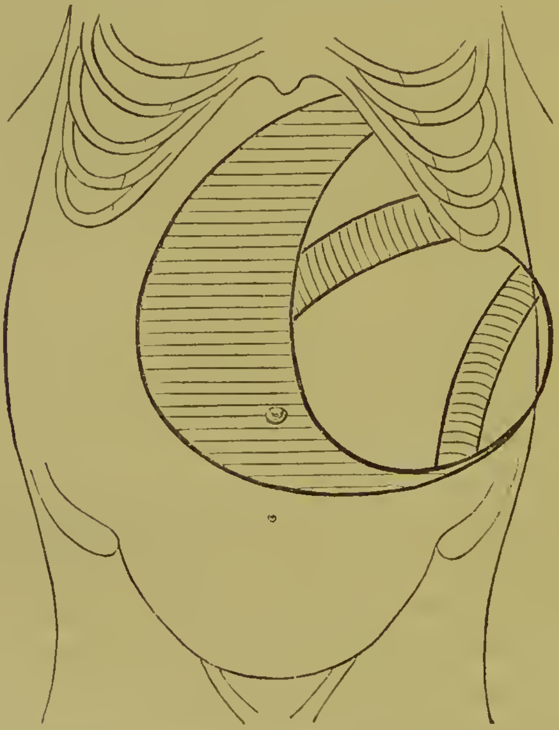
[1] The accompanying cases of glandular simulating renal tumours are fully detailed in the *Path. Trans.* vols. xxi. and xxii. The woodcuts are reproduced from these volumes.



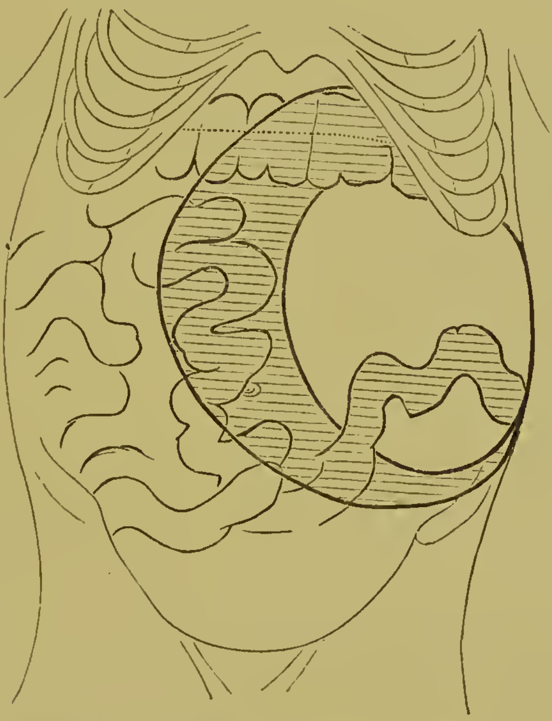
Tumour, outlined from life on last page, as displayed after death, and after removal of the small bowel. The cysts are somewhat collapsed. The scrotal prolongation is seen.



Mesenteric simulating a renal tumour as seen during life. The shaded portions were covered by bowel, two coils of which could be traced in front of the tumour. (See woodcut on next page.)

from fæcal accumulations.

There may be enough resemblance between a fæcal mass in the ascending or descending colon and a renal tumour to make it needful to state the distinctions. A floating kidney, which may lie under the parietes entirely uncovered by bowel, may so nearly resemble a fæcal accumulation as to be not at once distinguishable from it. Both are readily movable under the hand, and both give on percussion about the same amount of dulness, not profound, but that of a superficial mass lying upon the intestines. But a floating kidney is a rare condition, more often suspected during life than found after death. To recognise it with anything like certainty, not only should the shape and size be properly renal, but the hilum should be felt. What doubts remain may be solved by the action of purgatives. Not that an accumulation must at once disappear, though under treatment it will gradually lose



Mesenteric tumour as displayed after death. The upper part is crossed by the transverse colon; the lower part by a coil of small bowel between the layers of mesentery attached to which the tumour was enclosed, one layer passing upwards, the other downwards over it.

bulk and eventually do so. The resemblance between a fæcal mass and a floating kidney does not hold in the ordinary conditions of renal disease, the deep connections of a renal enlargement and the existence of bowel before it being enough to exclude any such question.

CHAPTER VI.

PATHOLOGY AND VARIETIES OF RENAL TUMOURS.

Renal tumours may be solid growths, or distensions by liquid, or a mixture of both.

They may be conveniently arranged as follows:—

1. Cancer or carcinoma. Comprising the subdivisions encephaloid, scirrhus, and colloid.
2. Sarcoma. Mostly of a highly malignant character.
3. Fibro-fatty tumour, a variety of sarcoma.
4. Fibroma.
5. Melanosis, often complicated with other growths.
6. Villous tumour. Associated with one of the former growths, but conveniently classed separately.
7. Lymphadenoma.
8. Tubercle.
9. Leukhæmic tumour.
10. Angioma.
11. Syphiloma.
12. Lipoma, fatty tumour, or replacement.
13. Bony or calcareous formations.
14. Cystic disease.
15. Hydatids.
16. Dilatations of the pelvis—hydronephrosis, pyonephrosis.

The purpose of the present chapter is to deal with growths, exclusive of tubercle, which is considered separately.

DISTRIBUTION OF MALIGNANT RENAL GROWTHS.

General distribution.

A few statements will apply to malignant tumours of the kidney in general, irrespective of any distinction between cancer and sarcoma—such a distinction, indeed, is a refinement of modern pathology; it is seldom to be established during life, and even after death is not evident, save to modes of examination which are not commonly employed.

Division into primary and secondary.

Renal malignant growths may be practically divided into primary and secondary, forming two classes of very unequal importance. When primary, the growth usually affects one kidney only, and destroys life by its progress in or about the organ in which it has originated. Secondary renal growths are continually bilateral; they usually escape notice during life, playing quite a subservient part to that in which they have originated. The secondary are the more common; speaking indeed of cancer, as distinguished from sarcoma, this growth is exceedingly rare in the kidney excepting as having originated elsewhere; tumours primary to the kidney are more often sarcomatous.

I have collected from the records of the hospitals with which I am associated, together with my individual experience, the notes of seventeen cases of malignant tumour primary to the kidney, and of twenty-three secondary to it. As they are for the most part unpublished, they form an addition, however trifling, to current knowledge.

Growths primarily renal.

To take first the class which, though the smaller, has the larger practical importance—malignant renal growths belong to two periods of life, early childhood and declining age; in late childhood and early adult life they are nearly unknown, at least as original to the kidney. The following table gives the particulars of distribution:—

Age at Death	0 to 5 yrs.	6 to 10 yrs.	11 to 20 yrs.	21 to 30 yrs	31 to 40 yrs.	41 to 50 yrs.	51 to 60 yrs.	61 to 70 yrs.	over 70 yrs.
Malignant growths primary to the kidney, 17 cases .	6	—	—	1	3	4	2	—	1
Malignant growths secondary to the kidney, 23 cases .	1	—	2	4	3	5	4	3	1

Primary . . Male, 9, female, 8.
Secondary . . ,, 15, ,, 8.[1]

The proportion of children affected is slightly greater than would generally present itself, as the table includes the experience of the Hospital for Sick Children, from which source two of the cases of primary and one of secondary growth were derived. The *post-mortem* examinations at this hospital from its foundation to March 1878 are 1,084 in number. These comprise, besides the cases of renal growths just referred to, eleven of so-called cancer beginning in other organs; but the disease had not originated in any organ in more than one instance, excepting the skeleton and the peritoneum—each of which were primarily affected in two cases—and the kidney. The frequency of malignant renal growths in childhood may be associated with the fact that these tumours are generally of the nature of sarcoma, and belong, like the tumours of the eyeball, not infrequent at the same time of life, to the connective tissue. Tumours which originate in this tissue, whether as glioma or sarcoma, appear to be more common in early life than the strictly cancerous growths which take their rise in the epithelium.

Their frequency as compared with similar growths in other organs.

Whatever be the intimate structure of renal growths, they present in a large majority of instances the outward semblance of encephaloid. Like most new formations they are most luxuriant in childhood and present at this time of life the softest structure, and relatively, or even

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[1] Of the forty cases here referred to thirty-seven were described as encephaloid, two as scirrhus, one as colloid; but these distinctions had reference to little more than the consistence of the tumour, and are not to be accepted in reference to the minute structure.

Their luxuriance in childhood,

absolutely, the largest bulk. Sometimes the dimensions have been enormous. Spencer Wells[1] saw one in a child four years old which weighed between sixteen and seventeen pounds, and had grown so rapidly that hardly six months had elapsed from its appearance to its termination. An outline of the swelling is given at page 710, in juxtaposition to which is to be seen a similar outline from a boy of six who was the subject of a renal tumour[2] described as encephaloid, which weighed thirty-one pounds, the total weight of the child and tumour together having been 131 pounds, so that about a fourth of the creature was disease. A child of three years old, named Lily Langley, died under my care at the Hospital for Sick Children with a renal sarcoma, of which the relations are depicted at page 713; the body unopened weighed thirty-five pounds, the tumour eleven and a-half pounds, almost exactly a third of the whole.

and general large size.

The instance of a child three years old has already been referred to, in whom a renal sarcoma was mistaken during life for ascites, such were its dimensions and consistence. Dr. Roberts found that the average weight of the renal tumour in sixteen children whose cases he had collected amounted to eight and a-half pounds; the smallest weighed one pound nine ounces. Among fifteen adults the average weight was nine and a-half pounds, the growth in the smallest presenting about the size and weight of the natural kidney. Notwithstanding the large variations of size which renal tumours present, it may be stated, as a rule which has few exceptions, that a renal growth, though it may not protrude the abdominal surface, seldom fails to attain such a size as to be evident to the touch, though the nature of the enlargement has in many cases been misunderstood.

Usual limitation to one side.

Growths primary to the kidney usually belong especially to one. It is not the habit of any malignant growth, whether cancer or sarcoma, to start bilaterally, as do morbid actions which depend upon the blood or the nervous system, and the general truth that, however widely such growths may be scattered, one is generally to be recognised as the progenitor of all the rest, makes one suspicious of the double origin which, as far as the kidneys are concerned, is sometimes assigned to them. Among the nineteen cases of malignant disease primary to the kidney referred to at page 735 were four in which both organs participated.

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[1] *Dubl. Quart. Journ.* 1867, p. 129.

[2] Under the care of the late Dr. Hawkins in the Middlesex Hospital. Reported by Dr. Van de Byl, *Path. Trans.* vol. vii.

In two many secondary deposits existed elsewhere, so that one of the renal growths was probably of this nature. In the other two, growths were found in the two kidneys and nowhere else, so that independence of origin might be inferred; but in each instance the growths were greatly unequal in size, so that, to say the least, they were not simultaneous, and it is not impossible that the second may in each case have been the offspring of the first, though none elsewhere came under observation.

Among sixty-seven cases of primary renal so-called cancer collected by Roberts the disease was confined to one kidney sixty times. In seven cases both were involved, but in three only did the disease appear to be primary on both sides; in the other four one kidney was the seat of primary cancer, while its fellow contained only secondary nodules. Other writers, like Dr. Roberts, have collated published cases with similar results, but to quote any other statement from similar sources would be but to count the same cases twice.

Selection of side.

With regard to the lateral selection of renal growths the testimony is somewhat discrepant. Roberts found that of sixty unilateral cases each kidney was affected an equal number of times. Ebstein states that the right is more often attacked than the left in the ratio of 31 to 23. Among my cases, putting aside four which affect both kidneys, are eleven belonging to the left side, only one belonging to the right.

Looking at the position of malignant tumours with

Position of growth with regard to kidney.

regard to the kidney itself it is apparent that there are two situations in which they chiefly begin—the cortical structure and the submucous cellular tissue. Cancers certainly begin as a rule in the cortex, but cases present themselves in which the growth is placed chiefly in the interval between the gland and the pelvis. This may be only because the growth has pushed in this direction, as in an instance under my own observation, where a tumour, regarded as encephaloid, largely occupied this position and protruded thence into the mucous cavity; but that it had begun in the renal substance was proved by the circumstance that the protruding part displayed upon its surface the divergent lines of a mammillary process, so that the growth had evidently begun behind this structure and pushed it before it.

But, beside such cases in which the cellular interspace is the apparent rather than the real source of the growth, others have been described, and the term *paranephric* applied to them, in which the actual origin of the cancer is here, and its subsequent progress directed not into the substance of the organ, but around it in connection with the capsule.[1] I have recently had a case of an abdominal tumour which was regarded, correctly as it proved, as a renal sarcoma. The growth, however, though in the closest contact with the glandular surface, was distinct from its substance, the gland being expanded into a shell over the tumour. No transition of gland into growth could be traced; and it was not possible but to conclude that the tumour had arisen between the kidney and its mucous or fibrous covering. Whether such growth arise, as has been supposed, in the endothelium of the blood-vessels I am unable to say. As to secondary cancerous growths, they are often seen around blood-vessels, as if brought by them or by the accompanying lymphatics; thus they may be placed in the cellular interspace of the kidney, just as similar formations may appear between gland and vessel in the portal canals of the liver.

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[1] Zenker and Schroeder, quoted by Ebstein, *Ziem. Cycl.* vol. xv. p. 668.

The malignant sarcomata are often so intimately associated with the interstitial tissue of the cortex involving the tubes within their encroaching bulk and spreading around the Malpighian bodies, that it must be inferred that the growth has begun in that tissue with the distribution of which its spread is so intimately connected; thus sarcomata as well as cancer would seem to be mainly of cortical origin. But either may spread in the submucous interval; and the position of secondary growths of either sort may be determined, as already stated, by that of the blood-vessels and absorbents in this situation. Lymphadenomata sometimes especially belong here, accurately following the submucous interval and dissecting the membrane from the gland.

DISTRIBUTION OF GROWTHS SECONDARY TO THOSE IN THE KIDNEY.

Secondary growths in nineteen cases of malignant tumour primary to the kidney, from St. George's and the Hospital for Sick Children, and private notes.

		Cases
No growth recorded except in one kidney		3
Both kidneys affected, no growth elsewhere		2
Both kidneys affected, one perhaps secondarily as other secondary growths existed		2
Conveyance by absorbents and blood-vessels.	Secondary growths in lumbar glands	9
	In mesenteric, omental, mediastinal, or cervical glands	5
	In lungs and pleuræ	6
	In liver	4
	In peritoneum	1
	In uterus	1
	In interior of cranium (?)	1
Extension by contiguity.	Involving supra-renal body	3
	Vertebræ	3
	Spinal cord	2
	Bowel	1

The influence of a malignant renal growth upon neighbouring and related structures is of more than pathological interest. Like other malignant tumours it not only travels

Dissemination and spread of renal growths,

along the lines of lymphatic and venous departure, but spreads by contiguity. It frequently encroaches upon the renal vein, and has been known to thrust itself in bulk into it and into the associated vena cava, and to reach the lung in the shape of palpable emboli. As a rule it appears to start by the absorbents; the lumbar glands, receiving as they do the lymphatics from the kidney, are usually infiltrated as the first step in the advancement of the disease: they may thus become converted into a cylinder, or irregular mass of malignant growth, which lies immediately in front of the spine, and in which the aorta and vena cava are completely imbedded. After the lumbar glands the infection is next poured into the thoracic duct and venous blood, and reaches the lung as presenting the first capillaries to be traversed after the infection has been discharged by the lumbar glands and entered the blood. After leaving the lung and reaching the left ventricle the infection is necessarily impartially distributed—sown broadcast through the system to bear fruit in whatever structure is suited to arrest the contagium and lend itself to its development. The liver and the general absorbent glands appear to be affected most often; the bones, the peritoneum, and the heart occasionally, but with less frequency. My series does not include an instance in which the heart was affected, but there are three in a list of fifty-one cases of primarily renal 'cancer' (for cancer read malignant growth) collected, mostly from published reports, by Dr. Roberts. In the same collection the bladder, uterus, penis, and testicle were each in one instance the subject of secondary deposits. But besides its distribution, as in these instances, by absorption and dissemination, it has other and more arbitrary modes of progression. It may happen that its most fatal and distressing issues are due to its annexation of organs and structures which have no association with it but one of vicinity. The most important result of this kind is the implication of the spinal column and cord. It has happened to me to witness two instances of this: one, that of Colonel

by absorbents and veins.

Extension by contiguity

to spine

H——, is related at page 779; the kidney was the seat of a malignant sarcoma; the vertebræ affected were the last three dorsal, and the first lumbar: the body of the last dorsal was so extensively destroyed that when the spinal canal was laid open after death the finger could be passed through a jagged hole from the spinal into the abdominal cavity. The resulting paraplegia, with paralysis of the bladder and deep bedsores, had been as complete as if the spine had been broken by external violence. In the other case, that of a man named Tempero, precisely the same vertebræ, the last three dorsal and the first lumbar, had been similarly involved from the same cause; and one, the eleventh dorsal, had been completely cut in two, so that the upper segment, during life, grated upon the lower with the distinguishing crepitus of broken bone—a phenomenon which was to be elicited by slight pressure upon the spinous process of the affected vertebra. In this case, although much cancerous matter was found in the spinal canal, there was no paralysis but of the bladder (see page 784). The bowel also suffers from its proximity to the renal growth: an instance has been mentioned in which the descending colon, and another in which the duodenum, was perforated. The latter bowel has been often completely imbedded in a malignant mass of renal origin, as in a subject examined at St. George's Hospital, and dilatation of the stomach has been known to have resulted from compression of the duodenum by the same means.

and bowel.

The aorta and vena cava may be in like manner nearly surrounded, insomuch that it is a matter of surprise that the vessels themselves escape destruction; they, however, though possibly compressed, preserve their integrity in a manner which shows them to be exceptionally resistant to encroaching growths.

The frequency with which the supra-renal capsule participates in renal cancer is no doubt due to its apposition rather than its susceptibility. It has often been noticed that a growth primary to the kidney rarely extends to the

Exemption of bladder and testicle when kidney is primary seat.

other urinary or genital organs: while it is by no means uncommon for cancer of the testicle to be succeeded by cancer of one or both kidneys. Transmission of the disease in the contrary direction is exceptional. The reason is not far to seek. Malignant disease is conveyed chiefly by the absorbents; those of the kidney pass to the lumbar glands, and so to the thoracic duct, their course lying above, and their current setting away from the pelvic and lower organs. These organs, of course, share in common with every other in whatever systemic contamination may exist, but they have no particular or special association with the morbid process beyond the exposure of the urinary mucous membrane to morbid discharges. But more often than not the growth is not exposed in the renal cavity, nor is the urine affected by it; and even when it fungates and discharges into the pelvis the discharge appears to have little of infective property. With regard to the conveyance of disease in the other direction, the lymphatics of the testicle pass directly into the lumbar glands, some to those of them which lie near the renal artery: if these become infiltrated the kidney may easily be affected by contiguity, giving place as it does to growths intruding from without. The prostate, bladder, and uterus are likewise connected with the lumbar glands, but less directly than is the testicle. Cancer of the kidney is not a frequent result of cancer of the uterus: it has been traced to cancer of the prostate.

though cancer beginning in testicle may reach kidney.

SUBDIVISIONS AND MINUTE ANATOMY OF RENAL GROWTHS.

Varieties of malignant renal tumours.

Malignant tumours of the kidney have been so generally described as cancer, that it was with much surprise that I found, on examining a number of specimens to which this name had been applied, that cancer, as structurally defined, was comparatively rare among them. By far the larger number of malignant renal growths fall within the definition of sarcoma; and the preponderance of this form of growth over the cancerous becomes still

Frequency of sarcoma as compared with carcinoma.

more marked if we have regard only to such as are primary to the kidney. Of eight tumours catalogued as cancer in the Museum of St. George's Hospital, two of which were specified as scirrhus, six proved to be not cancer but sarcoma, the term 'scirrhus' having been applied in each instance to a hard sarcomatous growth. Not that this is the only growth which may simulate renal cancer: I have come across two instances in which a formation apparently of this nature, and secondary to ulcerating cancer elsewhere, has proved to be nothing more than a cell-infiltration, inflammatory in nature, and probably akin to pyæmia.

Interstitial tissue as a source of morbid growth.

A profusely cellular, highly malignant, round-celled sarcoma is the most common of all renal growths. It is of interest to note that not only as concerns the forms of albuminuria, but also with circumscribed morbid growths, the most frequent seat of disease is the intertubular interval, and the growths to which the organ is most prone are exaggerations or perversions of its connective tissue. This has more than scholastic importance, for it helps to explain why renal tumours so seldom disturb the renal function. The growths, though within the capsule, may be called extra-glandular; they have no connection with the secreting channels, and only affect the secretion when by accident of fungation the products of their ulceration are mixed with the urine in the pelvis. Clinically it is but seldom possible to separate cancer from sarcoma, or to distinguish a renal tumour during life more narrowly than as being either one or the other: a clinical sketch must be common to the two, but to this must be superadded a word about the pathological characters proper to each.[1]

Cancer and sarcoma clinically indistinguishable.

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[1] In evidence of the relative frequency of carcinoma and sarcoma as renal growths, I may mention that in the course of a systematic examination of renal tumours by means of translucent sections, I found six instances of carcinoma to sixteen of sarcoma. The carcinomas comprised one case of colloid, one of scirrhus, and four of encephaloid. The colloid and scirrhus were primary to the kidney; one of the encephaloid was primary, two secondary, and one uncertain in this respect. Of the sarcomas, nine were primary to the kidney, six secondary, one uncertain. As to the structure of the sarcomas, fourteen of the sixteen were round-celled, the small-celled variety prevailing;

CARCINOMA.

Varieties

Cancers of the kidney are usually encephaloid; scirrhus, though often spoken of, is, in fact, exceedingly uncommon in this situation. I have ascertained a renal tumour to be strictly of this nature in but one instance, for the opportunity of examining which I am indebted to my friend Mr. C. H. Morgan. The subject was a man of the age of sixty-eight; the disease primary to the left kidney; the cause of death secondary growths of the same nature in the pleura, with consequent serous effusion. I have recently examined two other instances of supposed scirrhus of the kidney, and found both to be sarcoma. Colloid of the kidney is also infrequent; an instance will shortly be referred to (p. 743).

may be discrete or diffuse.

Two modes have been described in which renal cancer may begin, and the distinction may apply to other growths also. The growth may be discrete or diffuse. In the first one or more isolated and circumscribed formations appear in the cortical tissue, and sometimes project from it in enormous bulk, leaving some portion of the organ unaffected, except by distortion and displacement. In the other form the growth takes place generally throughout the organ, or mingles intimately with it

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two were spindle-celled. Among the round-celled varieties were five which the abundance of extravasated blood entitled to be called hæmorrhagic; two which were alveolar, and thus approached the characters of cancer. Alveolar sarcoma so nearly resembles cancer that it is with difficulty to be distinguished from it. It would indeed appear that carcinoma and sarcoma are not separated by so definite a line as modern pathology would indicate. The alveoli of a sarcoma may so nearly resemble cancerous loculi that it is only in other parts that the distinction is clear; and even with them it is not always conclusive, for the solid portions of a cancer are not always to be distinguished from sarcomatous tissue. I have seen at least one instance of a renal growth, which could not be regarded but as sarcoma, which was secondary to one in the rectum, which had been pronounced on microscopic evidence to be carcinoma. Clinically it is not possible to distinguish in the individual case, though we know generally that in one organ the growth is likely to be sarcoma, in another cancer. As to malignancy there is little to choose.

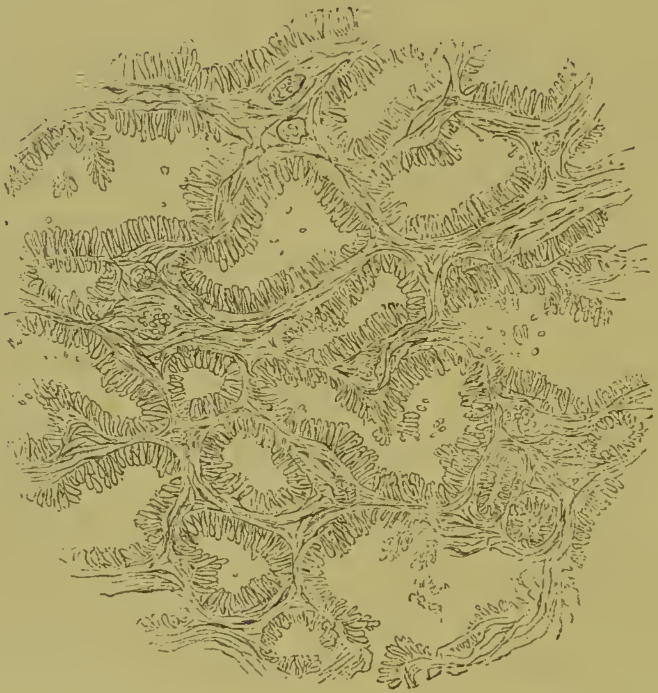
from many points, so that, however the organ increases in size, it retains much of its original shape. In the first form the tumour may be placed far away from the renal pelvis, and have no tendency to approach it; and indeed in every form of renal cancer fungation into the pelvis and the admixture of cancerous discharges with the urine is an exceptional event.

Minute anatomy of encephaloid and scirrhus.

To add the results of microscopic examination, encephaloid and scirrhus, usually beginning, as has been seen, in the cortex, there present their well-known alveolar structure. In the usual form each nodule or mass is limited by a capsule of fibrous tissue, around which the adjacent cortical structures, the tubes, and the Malpighian bodies are to be seen more or less compressed and concentrically displaced. Occasionally are to be seen outlying groups of cells, less completely encapsulated. The alveolar structure within, consisting as it does of a fibrous matrix excavated by cavities which are lined with, or irregularly occupied by, cells of epithelial type, has suggested an origin in transformation of the renal tubes. The cavities are most irregular in size and shape, but the smallest, whether seen in length or transverse section, sometimes present so nearly the dimensions and form of the renal tubes that it is difficult not to connect the morbid with the natural spaces. The superabundant and luxuriating epithelium, narrowed and elongated by the mutual pressure of the cells, may possibly be the only noticeable distinction between the section of a renal tube and that of a tube-like cancer cavity. The fibroid matrix of the kidney finds its analogue, and apparently sometimes its substitute, in that of the cancer. In the primary scirrhus already referred to, the fibroid tissue of the cancer presented an unbroken continuity with that of the kidney, as if it were not an addition, but an alteration. The fibroid mass imbedded here distinct kidney tubes and there cancer loculi, which so nearly resembled them that it was sometimes difficult to say which was tube and which was cancer cavity. The matrix, which could not be regarded

Relation of growth to renal structure.

otherwise than as that of the cancer, imbedded at its circumference Malpighian bodies, as if it were, or at least were inseparably joined to, the matrix of the kidney. Thus, in some cases at least, the transition from the structure of the tumour to that of the gland is as if one had been not so much replaced by as converted into the other. In other instances it is no less clear that the cancer-structure is not a conversion but an intrusion, for it is separated from that of the gland by a capsule, on the outside of which are Malpighian bodies and tubes, on the inside none. Secondary renal cancer can often be traced encircling the arteries, obviously disconnected from the glandular structure.



Secondary encephaloid. The growth is a pure intrusion; it displays none of the renal structures. (From a section prepared by Dr. Watney.)

Whatever be the relation of cancer loculi to cortical tubes it would appear from the frequent preservation of the natural characters of the urine, either that the altered tubes (if they be so regarded) either do not retain their connection with the pelvis, or fail to discharge their contents into it.

Epithelioma.

Robin[1] has described as epithelioma a renal cancer which had, in some respects at least, characters which entitled it to the name, though the bulk of the mass more resembled a degenerating encephaloid. The left kidney was the seat of a tumour, about five inches square, which had destroyed most of the organ save a cortical shell. The mass was in parts as hard as the normal renal structure, in parts like putty and in parts diffluent and creamy. Hæmorrhage had taken place into its structure in many places. The growth consisted mainly of cells, which, like cancer in general, presented epithelial types. They were of different sorts and sizes; some in particular approached the pavement or prismatic form, and if these were derived, which seems not improbable, from the mucous membrane of the pelvis, the term epithelial may be properly applied to this part of the tumour. The pelvis was occupied or replaced by the growth, and the infundibulum plugged with it. It is not impossible that the disease may have begun as epithelioma of the mucous membrane, and that encephaloid of the gland may have been secondary to it. A simple squamous epithelioma of the pelvis of the kidney, a *phthisis renum cancrosa*, has been described by Rindfleisch[2] in which a zone of white infiltration extends from the papillæ, which became early involved, for the depth of two or three lines into the renal substance.

Colloid:

Neither is colloid unknown in this situation. It has been described, together with encephaloid, and I may refer to a remarkable instance, which I brought before the Pathological Society, in which a kidney which contained some large calculi had become dilated into an enormous multilocular cyst, during life thought to be ovarian, and this, apparently as a subsequent process, had been filled with gelatinous material, which was undistinguishable from colloid cancer. As an additional peculiarity in this case, it appeared that portions of the contents of the cyst[1] escaped from time to time into the bladder, with temporary diminution of the tumour. The ureter after death was found to be pervious throughout, and somewhat dilated; the calculi, which consisted of phosphate of lime, were impacted at one side of its entrance.

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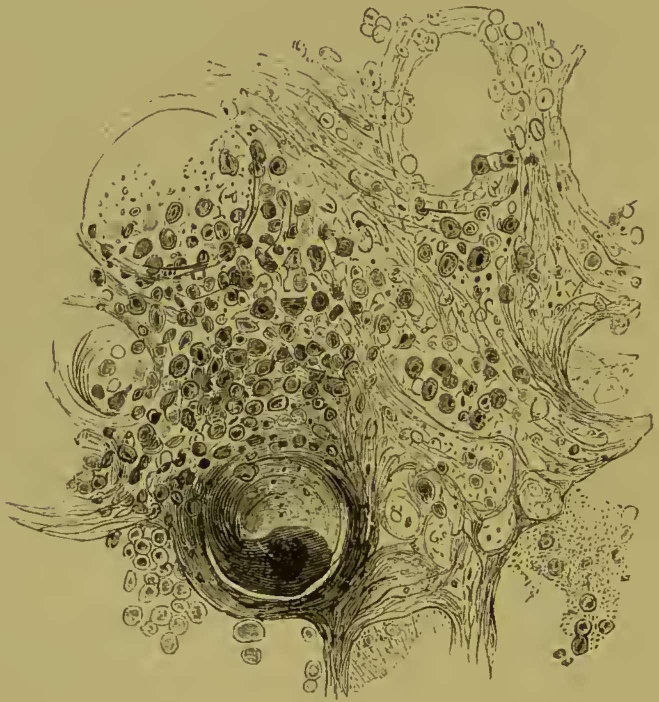
[1] Robin, *Mémoire sur l'Epithelioma du Rein*, quoted by Lebert, 'Traité d'Anatomie pathologique,' vol. ii. p. 350.

[2] Rindfleisch, *Path. Hist.* vol. i. p. 165 (Sydenham translation).

SARCOMA.

The forms of sarcoma which most often affect the kidneys are the highly malignant round-celled varieties, which start usually in the cortical, but sometimes in the submucous, connective tissue, grow rapidly, are soft, even



Round-celled sarcoma of very malignant type, from a child thirteen months old, under the care of Dr. Downes. The tumour was spherical, and six inches in diameter. The cells, which were intermediate in size (between those represented at pages 745 and 746), are seen mixed with blood-corpuscles in the swollen interstitial tissue of the kidney. A large blood-vessel is seen below and to the left, elsewhere the cavities for tubes. 'Cancer' said to be hereditary in family.

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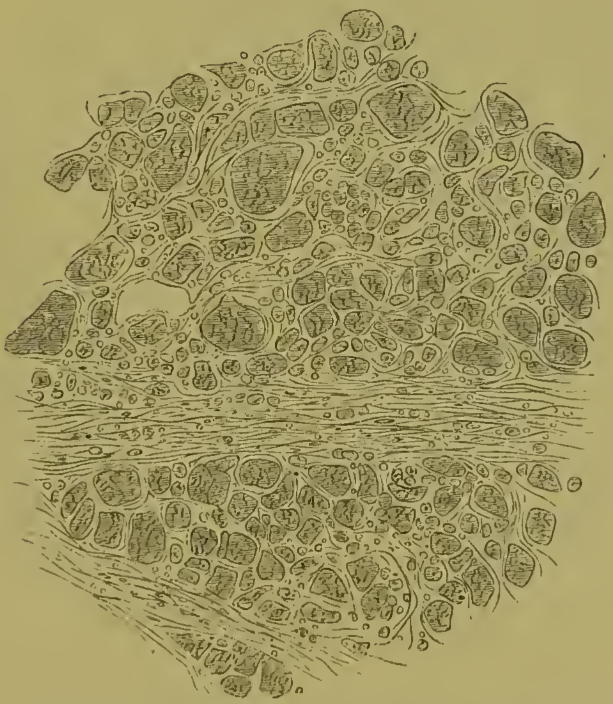
[1] *Path. Trans.* vol. xiii. p. 137.

sometimes fluctuate, and present so nearly the appearance of encephaloid, that they have been generally described as such.

its varieties.

The accompanying sketches will show the general characters of renal sarcoma. The growth is sometimes thickly encapsulated, and thus separated from the glandular structures; but more often the partition is indistinct, and the growth more or less diffuse, so that it spreads between and compresses the tubes, and surrounds the Malpighian bodies. Such growths consist usually of round nucleated cells, which present all the variations in size which sarcoma permits of; the small-celled varieties are the more common, but sometimes round cells of the largest variety are found, as in the specimen represented above. The intercellular substance is usually extremely scanty. It is sometimes to be noticed that the sarcoma has an alveolar arrangement, as shown in the woodcut

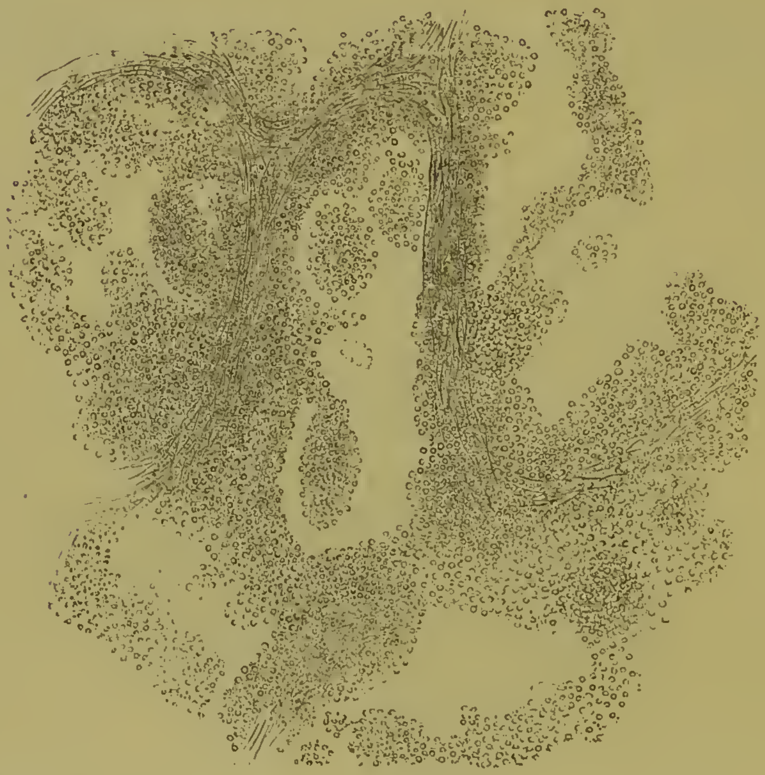


Large round-celled sarcoma, from the case of Tempero, related at page 784. Very large irregular more or less rounded cells enclosed in a delicate meshwork which is inseparable from the normal matrix of the kidney.

Small and large round-celled.

below, which enhances the resemblance to true cancer. The cellular growth is often to be traced in especial luxuriance along the margins of the new blood-vessels. The vessels themselves usually have thin walls and great calibre, so that extravasation takes place readily and profusely, insomuch that in many instances the tumour after death has presented the appearance of mere blood-clot, the sarcomatous skeleton revealing itself only on

Occasional alveolar arrangement.



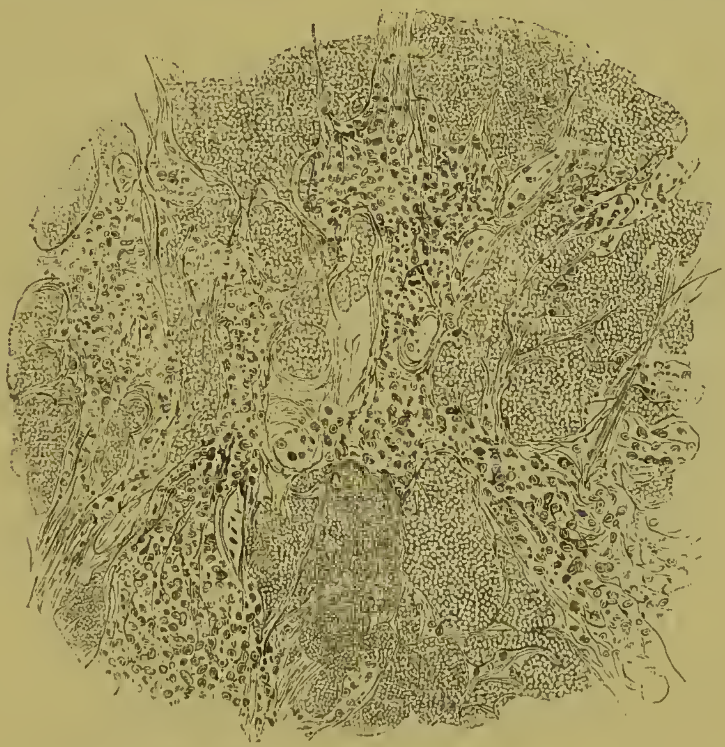
Small round-celled sarcoma, the cells arranged along partitions of fibroid tissue and blood-vessels. (From a preparation at St. George's Hospital formerly described as scirrhus.) Similar growths found in other parts of body.

Hæmorrhagic complication.

examination in section. This was the case with regard to a tumour represented at page 747, which 'in the recent state looked like a mass of coagulum.' It is preserved at Charing Cross Hospital, and I have to thank the then curator, Mr. Bellamy, for allowing me to open and examine the preparation. Not only is blood thus found in the recent state, but these tumours are apt to display cavities full of fibrine, evidently the relics of former hæmorrhages, and to be sprinkled with blood-crystals.

Occasional resemblance to lymphadenoma.

Hæmorrhagic sarcoma sometimes presents a somewhat equivocal resemblance to lymphadenoma; and perhaps if one were to judge only by the minute structure it might not be possible always to decide between the two; but the distinction involves more than microscopical detail—it relates to the origin of the growth in connective or lymphatic tissue, and its association with formations elsewhere in one situation or the other.



Round-celled sarcoma which in the recent state resembled a mass of coagulum. The blood, to be distinguished from the growth by the small size of the corpuscles, is contained partly in large vessels, but chiefly as extravasation in the substance of the tumour.

Two instances I have to refer to as thus equivocal were both of growths so largely and so uniformly mixed with extravasated blood, that by the naked eye they were undistinguishable from recent coagulum.[1] The first case was reported by Dr. Whipham in the 'Pathological Transactions,' and described by him as lymphadenoma. The kidneys and the uterus of a woman who died at the age of forty-three, apparently of bronchitis, were found to be studded with small elevated patches of dark colour and irregular shape, which were at first thought to be simple extravasations. A further examination of the spots in the kidney showed, however, that a new growth was comprised within each hæmorrhagic patch. This consisted of a multitude of somewhat irregular nucleated cells imbedded in a delicate reticulum, which was apparently a swollen condition of the interstitial tissue. The new growth was rich in cells in proportion to the interstitial substance, and was largely mixed with extravasated red corpuscles. The growth would appear to be of connective-tissue origin, and to be entitled to be called sarcomatous; a view which, I may say, has the concurrence of the excellent pathologist who formerly described it as lymphade-

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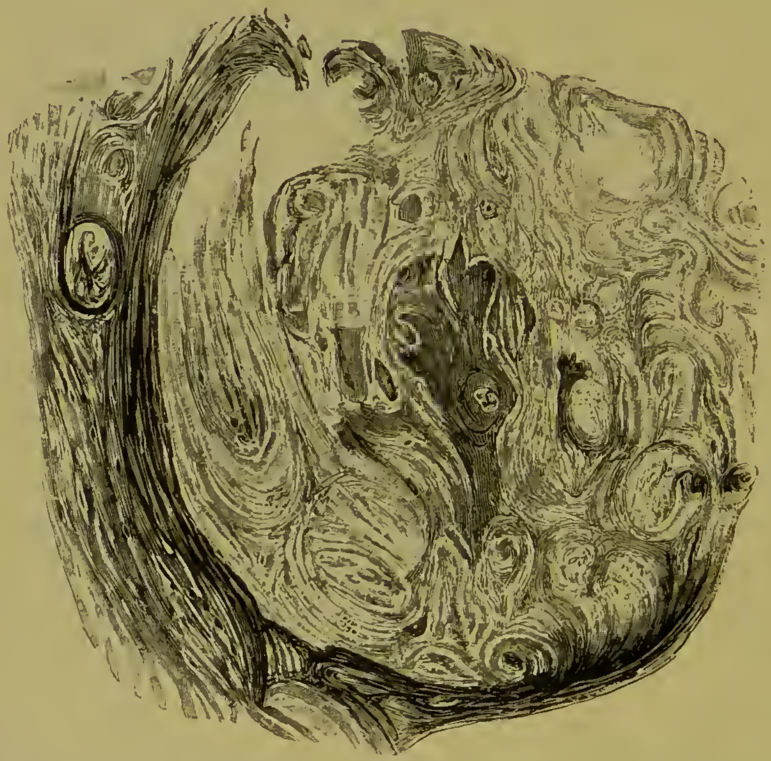
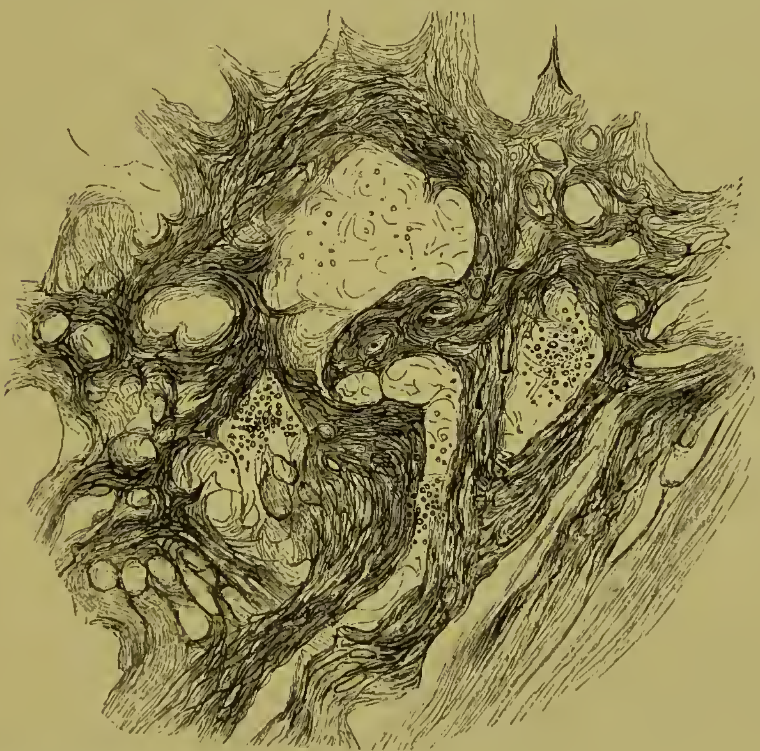
[1] *Path. Trans.* vol. xxiii. p. 166.



Malignant spindle-celled sarcoma consisting of intertwisted bands of delicate fibroid tissue with few nuclei. (From Colonel H——, see page 779.)

noma. The marks of distinction, however, are not so sure but that there might still be room for difference of opinion, were regard had only to the microscopic characters and not to the organic situation.

The next instance was brought under my notice by Dr. Grigg, who sent me the kidney of an infant, which proved to be the seat of a growth in some respects similar to that already described. The cellular interspace between the gland and the pelvic mucous membrane had been accurately and uniformly filled with what looked like recent blood-clot. It had the colour and somewhat the granular texture of raspberry jam, a shade lighter, that is, than simple coagulum. The maximum thickness of this mass was about half-an-inch. Hardened and examined in section, it proved to be, as had been conjectured, a cellular growth, into the interstices of which bleeding had occurred. It consisted of a mass of small cells or



Malignant spindle-celled sarcoma, the twisted fibrous tissue involving a number of cavities containing shapeless débris. (From Colonel H——)

nuclei, much like white blood-corpuscles; these were sometimes in apparent contact with each other, but in places were separated by the threads of a very definite reticulum composed of small spindle-cells. In some places the mass was traversed by thick bars of common fibrous tissue. It contained in places crowds of red blood-corpuscles and large sprinklings of hæmatine. Blood-vessels of considerable size were found in it, their edges in some places fringed with extravasated blood. The mass, though in some parts not unlike a lymphoid growth, and in others like a mere extravasation, presented on the whole rather the characters of sarcoma, with which accordingly it is classed.

Malignant spindle-celled sarcoma.

Although the round-celled sarcoma is the more common renal form, the spindle-celled variety is not unknown. A remarkable instance of this kind, which might be called fibro-plastic or fibro-recurrent, is illustrated by the woodcuts on the preceding pages.

The case to which these refer is given in detail in the next chapter, and the tumour there described. Though hard and slow of growth, it proved eminently malignant in character.

FIBROUS AND FIBRO-FATTY TUMOURS.

Tumours which have been thus described would probably in most instances fall within the definition of sarcoma, or at least be so nearly allied to it as scarcely to call for separate consideration. Some years ago I exhibited a large renal tumour[1] as fibro-fatty—a term which its constitution appeared to justify; it consisted of a grey translucent fibrous basis, in which no cells or nuclei could be found, which enclosed a yellow, opaque structure chiefly composed of aggregated oil-globules. Dr. Bristowe[2] produced, as a companion to this, another renal tumour which presented precisely the same admixture of fibrous tissue and oil-globules. I am now enabled, by means of methods of section which were not in use when these growths were presented, to add to, and in one respect to correct, the description of the one for which I am responsible. Though considerable districts of this consist, as described, of mature fibrous tissue, yet in other parts it proved to be densely nucleated, notwithstanding that the nucleation was not apparent under the rougher methods by which the growth was at first examined. It was also traversed by wide thin-walled blood-vessels, and had, in short, the characteristic structure of a small-celled sarcoma. The growth, in fact, is but a variety of sarcoma in which extensive fatty degeneration has occurred.

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[1] See *Path. Trans.* vol. xiv. p. 187, where the growth is represented in a coloured plate.

[2] *Ibid.* p.190.

Fibro-fatty tumours are degenerated sarcoma.

Simple fibrous tumours have been described in the same relation, but it is not improbable that further examination might place them in the same category. Dr. Wilks[1] displayed one about as large as a child's head, in which the form of the kidney was almost exactly preserved. It was very hard and looked like fibro-cartilage, but proved to consist of fibrous tissue only. It had been of such a size as to attract notice as an abdominal tumour for six years; four years before this there had been hæmaturia and pain in the loins; so that ten years may fairly be assigned as the duration of the growth. Beside such larger tumours as have been referred to, small fibromata, from the size of a pea downwards, have been found harmlessly disposed in the midst of healthy renal tissue. Tubes have been traced into them and they have been thought to be, as indeed are most renal tumours of the sarcomatous kind, mere exaggerations of the interstitial tissues.[2]

Simple fibrous tumours

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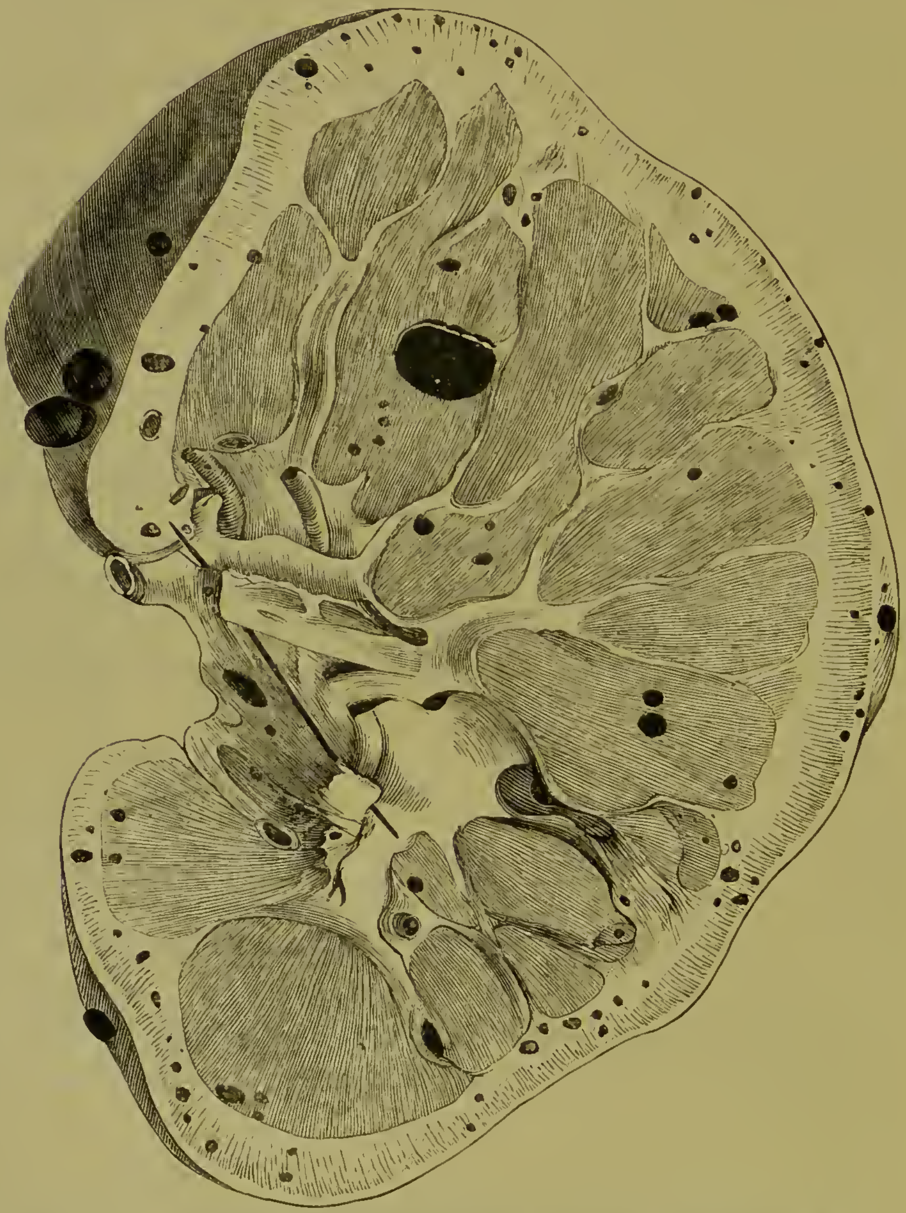
[1] *Path. Trans.* vol. xx. p. 244.

[2] Rindfleisch, *Path. Hist.* (Sydenham Society), vol. ii. p. 168.

MELANOSIS.

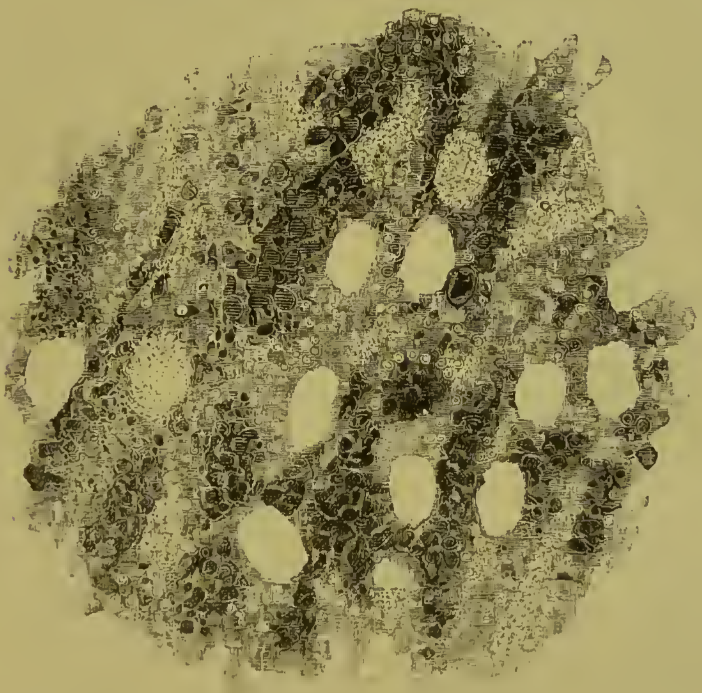
Black growths or deposits have been met with in the kidney, and sometimes described as cancer, though it is



Scattered melanotic deposits in kidney. (From a preparation at the College of Surgeons.)

probable that the term, in its present restricted sense, would not always apply. Walshe observes that the melanotic discolouration of cancerous masses is occasionally, though rarely, met with in this organ,[1] and the similar pigmentation of sarcomatous tumours is not an unfamiliar experience. But melanotic formations may take place independently, as it would seem, of any other morbid growth, simply as a development of pigment-cells in the interstitial tissue of the organ. The accompanying woodcut represents a typical example of this in the Museum of the Royal College of Surgeons, which by the courtesy of the curator, Professor Flower, I was enabled to examine

Melanosis occasionally independent of other morbid formations.



Magnified section of one of the black spots represented in the preceding woodcut, showing melanotic cells and granules in interstitial tissue. The Malpighian bodies and tubes are exempt.

with the microscope. The black spots, which were unattended with any obvious swelling or displacement of structure, were caused by the sprinkling of the interstitial tissue with large pigment-cells, or black débris, which had apparently resulted from their disintegration.

The cells were situated wholly in the intertubular district of the kidney, leaving the tubes and Malpighian bodies unaffected, but often strikingly outlined by the black matter. There was no evidence of new fibroid growth or stroma. It is to be noted that the discolouration affected the capsule where this was opposite to the black spots. In the same collection is another kidney, which is uniformly blackened throughout by a change to which the same name would be applied. At the London Hospital is a kidney apparently similar to the first-mentioned, in which the structure is dotted with black deposits varying in size from pins'-heads to peas. These have a powdery look, and are abruptly circumscribed, looking as if lampblack had been inserted into round cavities. There is no history. At King's College are several specimens, showing melanotic deposition in the same organ, in one of which it is associated with villus. Clinically the history of melanosis is that of the growth with which the pigment is associated; in addition[1] to which we have the fact that in certain instances the urine has been found to contain black pigment, either in casts, granules, or diffused colour.

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[1] Walshe, *On Cancer*, p. 380.

Villus.

Villous disease of the kidney is of great rarity. In most of the cases of which we have knowledge, it appears to be analogous to the well-known villous disease of the bladder, which is not malignant, and which belongs especially to the trigone. A striking example of villous disease of the kidney was related at the Pathological Society[2] by the late Mr. Campbell de Morgan; and by his courtesy I was enabled to have made the representation which is annexed.

Cases of villus of kidney.

This was obtained from the body of a woman who had died at the age of seventy-six, after an operation for strangulated hernia. During the preceding two years the urine had been albuminous, and she had had, at intervals of from two weeks to two months, attacks of hæmaturia, attended with pain in the renal region, so profuse as, on two occasions, to endanger life. On *post-mortem* examination the pelvis of the left kidney was found to be dilated

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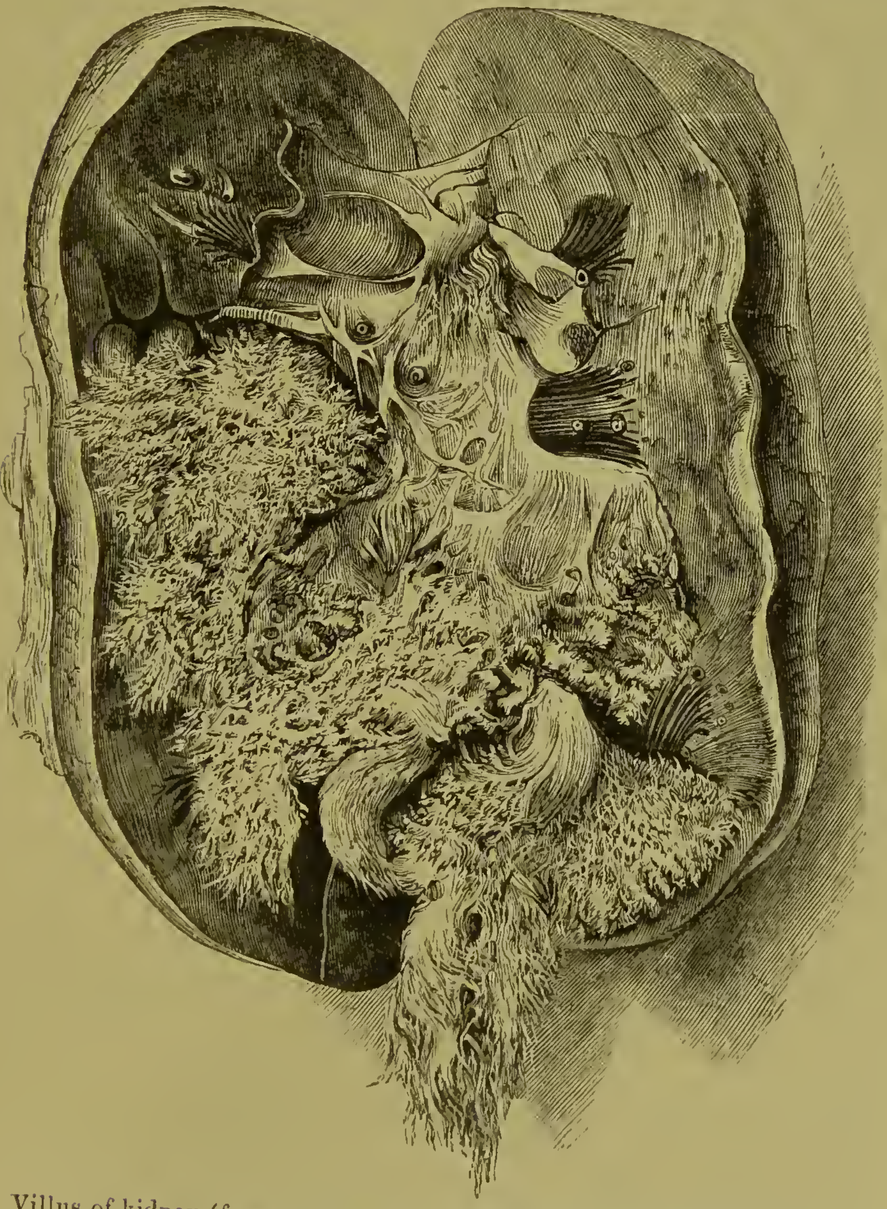
[1] Paper by Dr. Hilton Fagge, *Path. Trans.* vol. xxviii. p. 172.

[2] *Path. Trans.* vol. xxi. p. 239.



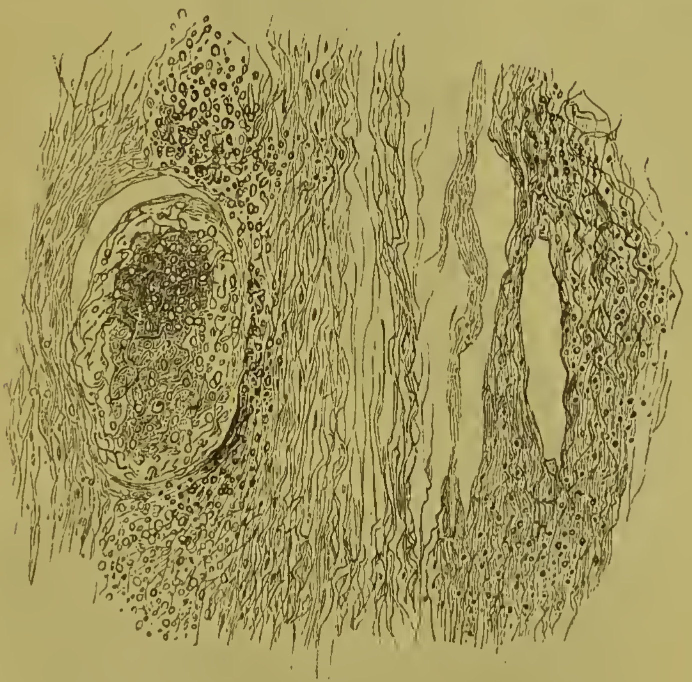
Villus of kidney (from preparation at Middlesex Hospital), described by Mr. Campbell de Morgan. The kidney is laid open and the growth seen to hang freely from the pelvis.

and full of what at first appeared to be a mass of thick shreddy pus. From this a fluid separated, which contained not pus-corpuscles, but nucleated cells, granular corpuscles, and the débris of cells, such as would give the impression that they belonged to a cancerous growth, leaving behind a soft mass of the size of a damson, which on washing spread itself out into the shaggy beard-like growth which is represented. The larger portion grew from the wall of the pelvis by a broad but thin pedicle, while smaller tufts were attached to other parts of the same membrane. A microscopic examination of the villi showed that many of them were coated with epithelium. They resembled those found in the non-cancerous villus of the bladder, though the latter, as Mr. de Morgan observes, are not commonly surrounded with an exudation so full of nucleated cells. The compact portion of the tumour was made up of a delicate fibrous stroma, from which a juice containing nucleated cells exuded. But that this structure was not truly cancerous was inferred from a disposition within the stroma to forms like those which constituted the villi, while in cancerous growths with villous surfaces the structure is purely that found ordinarily in cancer. The absence of secondary deposits bears out this view.

A somewhat similar case is reported by Dr. Murchison in juxtaposition with Mr. de Morgan's. A man sixty-five years of age was subject to attacks of profuse hæmaturia for fourteen months before his death. Latterly, after severe pains shooting from the right kidney to the pubes he became drowsy and nearly unconscious, with dry tongue, muttering delirium, hiccup, vomiting, and frequent convulsive movements. After death these symptoms, which had been correctly regarded as uræmic, were explained by the obstruction of both ureters by coagulum, and the filling of the pelvis of the right kidney with the same material. The uræmia was evidently the result of obstruction, but though no urine is mentioned as having been passed during the last four days, its suppression is not distinctly stated.

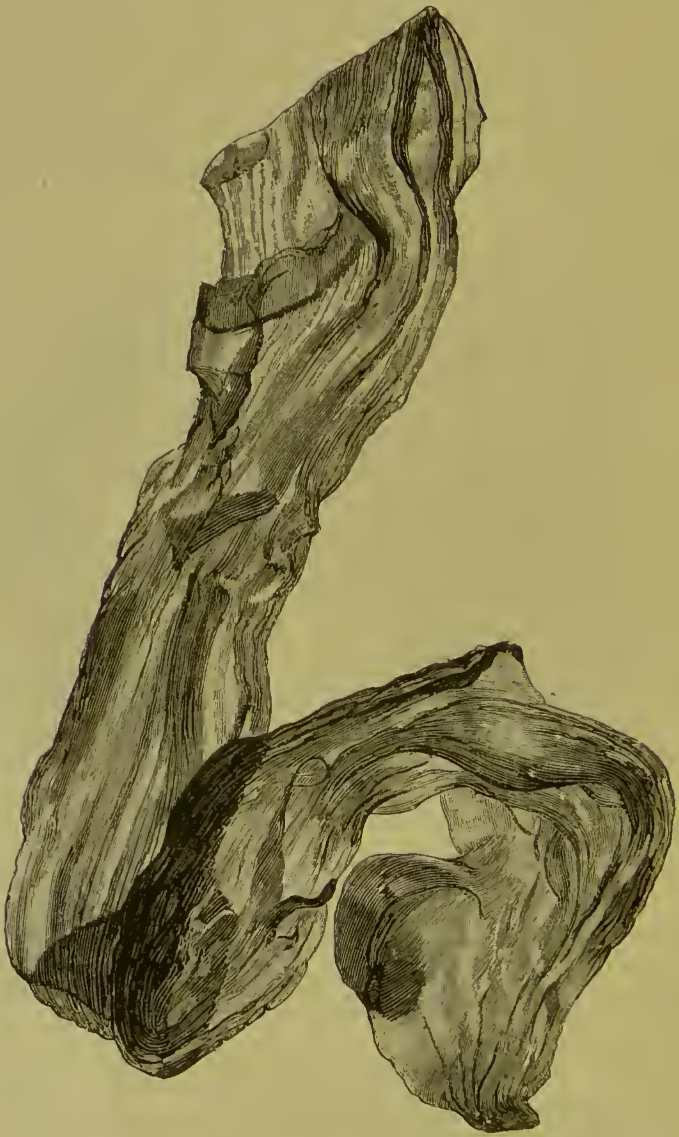
The bladder was studded with long villous processes, especially about the orifices of the ureters; while the pelvis and calyces of each kidney were similarly beset. These were from one to several lines in length; they were covered with a thin layer of epithelium, and included a capillary vessel full of blood. There was no secondary deposit, nor any formation of the ordinary type of cancer.

In Guy's Museum there is a preparation which displays a large amount of villous growth in connection with a diseased kidney, which is enormously dilated, evidently from calculi, one of which still remains in one of the calyces. The colon is adherent and its cavity is connected with that of the kidney by a sinuous opening. From the lining of the pelvis hangs a quantity of shaggy villous growth, and to a different part of the same cavity is attached a quantity of more solid pendent matter, which looks like villous structure associated with some more solid material.



Section from the cortical structure of the villous kidney (at Guy's Hospital). A Malpighian body is seen surrounded by nucleated fibroid growth of sarcomatous character.

The disease is described in the catalogue as malignant, but there is no reference to cancer or growth in any other organ. Through the kindness of Dr. Hilton Fagge, I was enabled to examine this interesting specimen with the microscope. The solid growth of which the walls chiefly consisted was made up of spindle cells of the sarcomatous type, with intervals here and there in which numbers of small round nuclei were closely packed. These were related to the interstitial tissue of the kidney, and could often be traced abundantly surrounding the Malpighian bodies, which themselves were unaffected. The vascular loops which constituted the villi were thin tubes of simple



Single detached pendent blood-vessel. (From preparation referred to in preceding figure.) The process displays little more than thin and bare membrane.

and bare membrane. The growth is clearly related to sarcoma rather than cancer. Its apparent origin in calculous irritation is of interest.

In the Museum of King's College is a preparation showing the concurrence in the kidney of villous structure with melanosis.

Symptoms

The symptoms of villous disease of the kidney are sufficiently indicated in the preceding cases. Attacks of hæmaturia, which completely intermit, but so profuse as to endanger life; possibly some dull pain in the lumbar region, but no acute pain anywhere; urine simply mixed with blood, without deposit to indicate its source, or, if we may reason from the analogy of the vesical villus, with which indeed the renal villus appears to be generally associated, containing loops of blood-vessel without surrounding tissue. These are, of course, pathognomonic; but they may be searched for repeatedly and in vain. On the other hand, though the disease be villus, it is possible, if the bladder be affected, that the urine may abound with epithelium, the result of secondary cystitis. This indeed, beside the blood, may be the only product of a villous growth. Its situation as between the kidney and bladder must be determined by the general indication of the symptoms, as pointing to one organ or the other as the seat of disease.

Lymphadenoma.

The kidney is by no means an infrequent seat of lymphadenoma. The growth as it occurs in this organ presents points of contact with sarcoma, insomuch that tumours occur of which it is difficult to determine whether they belong to one or the other: one part of such a mass may resemble a growth of lymphatic origin and another part be indistinguishable from one of the small-celled sarcomata already described.

Relationship to sarcoma.

To take first the common and unequivocal form of the disease, it occurs in the kidney only as part of a general disorder, formations of the same nature being found also in the lymphatic glands, probably in the spleen, and occasionally in the liver and lung. The importance of the disorder is rather general than local; or so far as local symptoms obtrude themselves they relate to the swollen glands rather than to any internal organs. The renal symptoms, if such there be, have been hitherto overlooked in the presence of the signs of lymphatic anæmia, which mark the fatal tendency of the disease. It is worth noting that in Dr. Murchison's case,[1] which furnishes the most extreme example of renal lymphadenoma which I am acquainted with, the urine was found to be pale, clear, and free from albumen.

Description of growth.

The appearance of the kidneys under the disorder is sufficiently striking. Rounded masses of variable size beset the renal substance, more especially in the cortex, and present themselves, often numerously, under the capsule. In this position they usually display a circular outline, though when cut at right angles to the surface they may give one which is elongated or pear-shaped. In the typical example figured by Dr. Murchison the masses, of which about a hundred are displayed on the lateral aspect of one kidney which the drawing presents, vary in diameter from about three-eighths of an inch to the size of a mustard seed. The growths, however, have often been known to exceed in size the largest of these. They are yellowish-white, somewhat like large masses of tubercle, but are harder, closer in grain, and less apt to caseate. Microscopically they present the characters which belong to lymphoid growths generally—a strongly marked fibrous reticulum, which blends with the interstitial tissue of the organ, in the substance of which are crowds of small circular uniform nuclei, and in its spaces nucleated cells.

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[1] *Path. Trans.* vol. xx. p. 192. With the report of the case are excellent illustrations of the naked-eye and microscopic appearances. See also case published by Dr. Coupland, *Path. Trans.* vol. xxviii. p 126.

LEUKHÆMIC TUMOURS OR EXTRAVASATIONS.

White marrow-like tumours, consisting of white blood-corpuscles in a very delicate reticulum, varying in size from a mere dot to a cherry, have been described as occurring in the kidney in connection with the general condition of leukhæmia.[1]

Sometimes the extrasavations, though mainly consisting of white corpuscles, present so much the appearance of ordinary hæmorrhage that they are not to be distinguished by the naked eye from such sanguineous outbreaks as have been described in connection with some of the varieties of sarcoma.

Dr. Greenfield gives an instance of this in the 'Pathological Transactions' for 1878.[2] A child four years old, born of syphilitic parents, became the subject of purpura, and lapsed into a condition of extreme anæmia, in which it died. The blood displayed during life an excess of white corpuscles. Not to mention many external ecchymoses, the most remarkable changes found after death were in the liver and kidney, and were due to the extrusion of white corpuscles into the interstitial tissue of these organs. In the liver this took the form of a white veining, corresponding with the interlobular divisions of the portal canals, which was found to consist of extravasated leucocytes. In the kidneys patches of extravasated blood were found underneath the capsule. The cortical surface was marked by large irregular hæmorrhagic blotches, which were slightly raised, and were but the bases of cone-shaped hæmorrhagic masses, which penetrated deeply into the organ. These masses consisted of extruded leucocytes, which had collected abundantly between the tubes and outside the Malpighian bodies. These were not separated by any stroma, save a delicate interlineation of fibrinous threads.

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[1] Rindfleisch, *loc. cit.* vol. ii. p. 168.

[2] *Path. Trans.* vol. xxix. p. 298, plate xiv.

ANGIOMA.

Cavernous tumours such as are found in the liver have been described in the kidney, but these have no practical importance.

SYPHILOMA.

Syphiloma must be briefly mentioned as a renal tumour, though the local is of quite secondary importance to the constitutional affection.

Appearances.

A syphilitic tuber as large as a small potato is described and figured by Dr. Moxon [1] occupying the renal glandular substance nearly from the pelvis to the capsule. A minute examination showed that the tumour essentially consisted of a profuse nuclear growth in the intertubular portion of the organ. Both kidneys were enlarged and lardaceous; the pair weighed twenty-two ounces. The enlargement of the left, in which was the tuber, was felt from the front during life. The patient had the general signs of syphilis, together with general dropsy and pale albuminous urine. The latter symptoms were probably to be attributed to the lardaceous disease; the localised swelling, however, is more distinctive.

General symptoms.

A few similar tumours have been described by other writers; they appear to have been invariably imbedded in lardaceous kidneys, by which the symptoms are necessarily masked.

I have seen patches of fibrosis in the kidney in connection with congenital syphilis; it is probable that general fibrosis of the kidney, as of the liver, may sometimes have this origin.

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[1] *Guy's Hospital Reports* for 1868, p. 393, plate i. See also Cornil, *Journ. de l'Anat. et Phys.* 1865, p. 97.

FATTY TUMOURS AND TRANSFORMATIONS.

Condition of origin.

The kidney offers no exception to the law that morbid growths are but exaggerations of normal structures. Thus the growths which arise in this organ are comparatively few; possibly cancer from the tubes, certainly sarcoma from the interstitial structure. This structure may also degenerate into oil, and in certain circumstances become converted into fat, as is rendered probable by the occasional substitution of the glandular tissue by this material. Under irritation, more particularly such as is connected with stone, pyelitis, or the retention of urine, fat is apt to increase in connection with the capsule and in the pelvic or interlobular cellular-tissue, until it may happen, should the growth be associated, as it often is, with a corresponding atrophy of the glandular structure, that fat may largely take the place of the shrunken organ. This is a form of fatty substitution rather than tumefaction, and there is another change to which the same term may be applied. Instances have been described in which the whole glandular tissue of the organ has been transformed into fat, in which little or no trace of the proper structure remains, though the cones and the cortex are distinguishable from each other.[1]

Circumscribed growths of fat, of the nature of fatty tumours, have been described underneath the capsule, but these are small and of no practical importance.

BONY, CALCAREOUS, AND CARTILAGINOUS GROWTHS.

True bone very rarely occurs as a renal growth, though an instance has been referred to in connection with pyelitis (p. 660). Cartilage is of less frequent, and even doubtful, occurrence.

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[1] Rayer, *loc. cit.* vol. iii. p. 616. Ebstein, *Ziemssen's Cyclopædia*, vol. xv. p. 635. Dr. Hullett Browne, *Path. Trans.* vol. xiii. p. 131.

There are many preparations in museums which show formations within the kidney of bony hardness; these appear to be usually derived from the transformation of hydatids. There is such a specimen at Guy's Hospital, which is described in the catalogue as a 'kidney containing a mass of bone.' Under the microscope, however, no trace of osseous structure could be seen; the mass was simply cretaceous. There is a preparation at the College of Surgeons, in which the kidney of a man who for ten years had passed hydatids in the urine is transformed into an irregular ovoid mass of cretaceous matter, which has lost all renal semblance.[1]

Instances have also been described in which the capsule of the kidney has been partially '*ossified*,' to use the term commonly applied to the change. Dr. Elliotson sent to M. Rayer an atrophied kidney, of which both the pelvic mucous membrane and the capsule were represented by hard shells, but whether bony or only calcareous we have no means of ascertaining, probably the latter. The same writer[2] gives a representation of a tumour of bony consistence, as large as an orange, which occupies one end of the kidney. This was enveloped in a cyst of cartilaginous hardness; and altogether the description is suggestive that it may have been the residuum of a suppurating hydatid.

Abscesses, whether arising in hydatids or in tubercle, or independent of either, may become quiescent in the kidney, and be represented only by the cretaceous residue of the pus they have once contained. Thus the kidney may be practically destroyed by pyelitis, and the products shut up in the pelvis, until at last nothing remains but an innocuous though useless cyst, containing a mass of chalky or mortar-like substance.

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[1] Guy's Hospital Museum, 2034; College of Surgeons, No. 1,925A. See also a preparation at St. Bartholomew's Hospital, No. 26, 17.

[2] Rayer, *Maladies des Reins*, vol. iii. p. 608. Atlas, plate xxxvi. fig. 6.

CHAPTER VII.

CLINICAL HISTORY, SYMPTOMS, AND TREATMENT OF MALIGNANT DISEASE OF THE KIDNEY.

Cancer and sarcoma indistinguishable clinically.

Touching the symptoms of malignant disease of the kidney, no distinction is possible between cancer, properly so called, and the sarcomatous growths which take their rise in the connective tissue of the organ. And in regard to the literature of the subject, it is needful to bear in mind that what is generically described as cancer is seldom to be more narrowly interpreted than as an encroaching and destructive growth.

Causes of malignant disease.

In most cases the cause is undiscoverable. Those which present themselves to our notice are of two kinds, mechanical violence and stone within the kidney. Hereditary predisposition is not strongly declared, though sometimes apparent, as in the instance which is illustrated by a woodcut at page 744. Falls, kicks, and violent blows of several kinds which appear often to have affected the lateral aspect of the trunk, towards which the kidney is more exposed than directly to the front or rear, have been mentioned by many writers in this relation. Hæmaturia has been recorded in most instances as an immediate result of the accident. The growth has made its appearance at varying periods subsequently: in a case mentioned by Bright in little more than three months after the fall downstairs to which it was attributed, in other instances in six months, in another in two years. Renal stones are equally distinct antecedents of renal growths, whether of the nature of sarcoma or cancer, though they have attracted less attention in this relation than have injuries by violence.[1]

A case of malignant sarcoma which ensued upon years of suffering from renal calculi is detailed at the end of this section (Colonel H——). An instance of villous disease associated with sarcomatous thickening, is referred to at page 757, and an instance of colloid subsequent to calculous obstruction at page 743. There appears, indeed, to be no form of renal growth which may not be instigated by this irritant. Pathology abounds with instances in which malignant and other growths have been started by accidental irritations; cancer of the gall-bladder from biliary calculus is a parallel instance to cases in which the pelvis is the seat of the villous or other growth sequent upon renal stone; cases like that of Colonel H——, where the growth has begun apparently in the substance of the organ, are less easy to explain as the result of pelvic irritation; but that stone is more often a precursor of renal growths than can be explained by chance concurrence is certain.

Symptoms. The symptoms by which malignant disease of the kidney is commonly declared, are tumour, pain, hæmaturia, cachexia, which must be held to include loss of flesh and strength, and embrownment of the skin, and the several signs which denote the extension or transplantation of the growth to other organs, as to the spine or lung. In a large majority of cases the renal swelling

Tumour. presents itself as a palpable tumour; of all the signs of malignant renal disease this is the most constant. The swelling, particularly in children, may appear as a prominent, or even as an exceptionally large, abdominal tumour. The relations and means of identifying renal tumours have been already stated (p. 704); it only remains to say, with regard to those of malignant character, that they are not always conspicuous; deep handling of the belly may be needed for the detection, and even this may be ineffective until the muscular resistance has been overcome by means of chloroform. As an instance of the smallness of a renal tumour which may be thus recognised, I may refer to the case of Tempero (p. 784). The enlargement of a renal growth is almost always chiefly in front, though some degree of fulness and levelling up of hollows is to be felt in the lumbar region. As an exception must be mentioned a man who was in St. George's Hospital, under the care of Mr. Holmes, and whose case is related in the 'Pathological Transactions.'[1] A large pulsating swelling occupied the lumbo-sacral region on the left side, and emitted a low soft blowing murmur. This was found to have been produced by a highly vascular malignant growth belonging to the corresponding kidney, which was enlarged thereby to the weight of 30 oz. Among nineteen cases of malignant tumour primary to the kidney of which I have the particulars before me, there were but three in which a tumour was not detected during life. Among the three exceptions was one in which, though a large tumour existed, and was suspected, tenderness from peritonitis forbade its being adequately sought; in one of the others a tumour which could have been easily felt escaped notice, for no other reason than that it was not felt for; in the third, the renal mass weighed 17½ oz., and possibly would have been detected, had not implications of the brain or skull withdrawn attention from what was probably the first seat of the growth. Thus in all a renal tumour was, if not perceived, at least perceivable; those which escaped notice were not indeed so small as some which were found. But though renal growths are generally to be distinguished as palpable swellings, they are not so easily to be known as renal; in one of the cases referred to the tumour was supposed to be a slight enlargement of the spleen, in another to be an ovarian cyst.

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[1] *Abdominal Tumours* (Sydenham Society), p. 230.

Pain.

Next to swelling perhaps comes pain in order of frequency as a symptom of malignant disease of the kidney. Children with large soft tumours often appear to be free from it, but elder persons with harder growths are seldom so, and sometimes suffer severely and persistently. The harder the growth, as a rule, the greater the pain. It is dull and wearying rather than acute, and is not greatly intensified by movement, these circumstances marking the distinction between pain from this source and that from stone. The pain of malignant growth is usually most marked about the proper renal region on the affected side, and is accompanied by tenderness, which may make the patient keenly conscious that the fingers of the explorer are exactly adapted to the seat of the disease. The line of the ureter and the testicle are less affected than with stone. The extension of the pain to the spinal region, more particularly if tenderness over individual vertebræ belonging to the lower dorsal or upper Paraplegia lumbar region can be recognised, is a sign of the extension of the disease in this direction, and an indication at once of its nature and of its impending termination. Pain down the thighs may accompany this extension, and be shortly followed by paralysis, first of the bladder, and possibly not extending to an observable extent further, to be succeeded, should time allow, by paralysis of the lower limbs, and the sphincter ani, and uncontrollable bedsores.

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[1] Vol. xxiv. p. 149.

Cachexia. Perhaps the next degree of significance must be attached to the constitutional results of malignant disease in loss of flesh and change of colour; with the rapid growths of childhood the complexion may remain perfectly unaffected, and loss of flesh be at least not observable until late, but with older subjects both emaciation and tinting of the skin may be very conspicuous, the lean figure and brown face possibly giving a delusive suggestion of tropical experience. With this, or apart from it, is sometimes an extraordinary failure of strength, spirits, and vitality; the patient may sicken of a vague disease, get thin and weak, take to his bed without pain or definite complaint, and at last die without giving up his secret. Uræmia rarely, if ever, appears as a result of renal growths.

Hæmaturia.

Hæmaturia has been variously estimated as a symptom of malignant disease of the kidney. It perhaps has no greater value in this relation than as present in an important minority of cases. I have before me the notes of seventeen, of which hæmaturia was known to have occurred in six, in one of which (Colonel H——, p. 779) it was probably due to stone, which existed as a complication. Roberts, out of fifty-nine cases, collected mostly from published records, found mention of this symptom in thirty-one, in five of which there was intervention of other possible cause—stone, Bright's disease, or external violence. Ebstein, in his larger compilation, found notice of hæmaturia in twenty-four out of fifty cases.

Renal cancers, though possibly tubal in their origin, are commonly separated by encapsulation from the proper glandular structures; sarcomata, though often diffuse, are interstitial in their position. Cut off as both are from the tubes and Malpighian bodies, neither, as a rule, bleed into the urinary passages, except as the result of fungation into the pelvis, either by participation of the mucous membrane in the disease, or by protrusion by way of one of the mammillary processes. Thus hæmaturia is by no means of necessary occurrence, but when it does occur is constant. Rarely in the history of such cases an isolated hæmorrhage has been reported early in the disease, as in the instance related at page 784, where the urine was said to have been bloody four years before death, and to have recovered its normal characters. Possibly in such circumstances the kidney becomes congested under the early process of morbid growth, but the rule that hæmorrhage in connection with renal tumours indicates ulceration into the urinary passages admits of few exceptions. The bleeding, once begun, is generally continuous, if left to itself, though it does not entirely ignore styptics. It is often profuse enough to cause anæmia, though less so than that which proceeds from villous growths of the bladder.

The renal characters of the hæmaturia are generally at once evident. The blood is generally more tawny or embrowned than when from the bladder, and is so uniformly admixed with the urine that each micturition is bloody from first to last; the latter portion perhaps more so than the earlier, but not with the accumulation of blood at the end which belongs to vesical hæmorrhage. The bloody sediment is powdery and incoherent. Clots, if any occur, are small and generally somewhat fibrinous or decolourised; they may have a slenderly vermiform shape which they have taken from the ureter, but this is infrequent. Bladder-clots are usually soft and red as if newly congealed; they are shapeless, and often of such bulk that their escape by the urethra would seem an impossibility; they are often indeed shot out only after prolonged effort. Renal hæmorrhage, on the contrary, though it has been known to cause obstruction of the ureters, and fatal suppression, seldom if ever impedes the urethral exit. The hæmorrhage, unlike that from renal calculus, is not more abundant on going to bed at night than on rising in the morning—indeed, the reverse is often the case, as if the discharge were favoured by the horizontal position; and the distinction from the bleeding of stone is further marked by the almost invariable cessation of the latter after some days in bed, while that of malignant disease is not much, if at all, lessened thereby.

Urine.

The urine, when not bloody, is usually perfectly natural—the growth has not broken into the pelvis, and the secretion is that only of the healthy glandular structure. As to the microscopic appearances of the urine, into which a morbid discharge has found entrance, it necessarily contains blood-corpuscles, usually in vast abundance, but never anything pathognomonic of their source.

Casts as a rule are absent—a negative symptom of some importance, as excluding a form of nephritis in which bleeding may be profuse enough to suggest a growth, but with which these evidences of disease are many, dark, and striking. Exceptionally casts are to be found. These may be the result of renal disease, only accidentally associated with the growth, as was probably the case in the instance mentioned at page 786, or they may proceed as may happen in connection with many localised renal changes from tubal disturbance in the immediate neighbourhood of the growth.

Absence of cancer-cells.

Pus if present is so only as an accident. 'Cancer cells,' or nucleated bodies which could pass for them, are conspicuously absent. With bladder cancers and villi, squamous cells, exhibiting every form of morbid luxuriance in nucleation and shape, are often abundantly found, and even considerable masses of cellular growth are sometimes expelled, within which blood-vessels can be detected.

The pelvic and vesical mucous membrane may be stimulated to desquamation by a variety of circumstances, some of a transient nature; and from one part or another cells of every degree of rotundity or flatness may proceed. But with renal tumours such evidences of disease are seldom, if ever, found. Reviewing my own experience, I have found cases in plenty where large cellular deposit has been associated with cancer of the bladder. I have known several in which the presence of cancer in some part of the urinary tract has been confidently presumed, in consequence of the abundance in the urine of nucleated and proliferating cells, and in which the recovery of the patient has negatived any such supposition. I have met with not a few in which a discharge of cells of epithelial type, together with blood, has been supposed to indicate cancer of the kidney, but not with one in which this supposition has been verified. If I am told that such an one is passing 'cancer cells' in the urine I conclude that, whatever his disease may be, it is not cancer of the kidney. A deposit consisting of blood-corpuscles, mixed, if with anything, with indefinite sanguinolent material, and that constant, during repose as well as under exercise, is a sign in this respect of more meaning. It is to be borne in mind that a fungating tumour of the kidney is less often cancer than sarcoma, the cells of which, associated as they are with connective tissue, are not to be easily and abundantly shed, while even should they reach the urine they are at least in the small-celled varieties, which are the more numerous, too small to attract attention when confused with red and white blood-corpuscles.

Other symptoms, spinal

The remaining symptoms of the disease may be termed accidental; they relate to extension of the disease to other organs than that primarily affected. That most distinctive of renal growths, whether cancerous or of the nature of sarcoma, is the spinal complication. With a considerable proportion of malignant renal growths the adjacent vertebral surface is more or less eroded, and the spinal column is sometimes cut through, as has been already described (p. 779), with evidences of spinal disease, severe pain in that situation, localised tenderness, and possibly, as noted in one instance (see case of Tempero, p. 784), crepitus, like that of broken bone, between the adjacent halves of a severed vertebral body. With these come the various stages of paraplegia, which, as far as I have seen, are apt to begin with paralysis of the bladder, and be evident there for a little time before the extremities are affected. The suffering which this extension may involve, the pain of the encroaching growth, the paralytic helplessness, the retention of urine, the non-retention of fæces, the deep and extending bed-sore, is more than is often comprised in the process of natural death.

and pulmonary.

Another result of malignant renal tumour, which, though indirect and not peculiar to disease of this origin, has yet been so striking in some instances which I have seen as to deserve especial mention, depends upon the conveyance of the morbid process to the lung, and takes the form of asthmatic or laryngeal dyspnœa. In one instance attacks like severe asthma occurred, which were unaccompanied with stethoscopic evidence of disease, completely intermittent, and were found after death to have been associated with scattered growths throughout the lungs (see p. 779). In another case there was severe dyspnœa on exertion, particularly on going upstairs, which the patient referred to the larynx, together with spasmodic cough like whooping cough, and the occasional raising of peculiar hollow sputa, around which a cellular or corpuscular growth was detected, foreign to the proper structure of the lung, which gave the only conclusive evidence as to the kind of disorder from which the patient was suffering (see case, p. 789).

Discharge of malignant matter by ureter,

Cancerous or malignant matter belonging to the kidney may be discharged, or intrude itself variously. A case is referred to (p. 743) in which colloid material from the interior of a kidney escaped from time to time by the ureter.

bowel,

A child three years of age, who was in St. George's Hospital with a large encephaloid (?) tumour of the left kidney, passed blood by the bowels, and then after an interval had much abdominal pain, vomiting, and purging, under which it sank, seventeen days after the discharge of blood. It was found that the descending colon and the tumour were firmly connected by adhesions, and that in the midst of the tumour was a cavity, due to breaking down of growth, the products of which had escaped into the colon by an ulcerated opening through its walls.

The duodenum has likewise been penetrated by a renal cancer, as in an instance recorded by Rayer,[1] in which a portion of a tumour of this nature, belonging to the right kidney, was found to have intruded itself through an ulcerated opening into the cavity of the bowel. Death had been preceded by obstinate vomiting and hiccup.

or superficially.

Perforation of the abdominal wall by renal cancer has been recorded at least in one instance: that of a child, three years old, mentioned by Abele, in whom a medullary growth of renal origin sprouted artificially, carrying with it a loop of intestine, which became gangrenous, and discharged fæces superficially.

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[1] *Maladies des Reins*, vol. iii. p. 705.

Duration of malignant growths.

The duration of malignant renal growths, most conveniently estimated independently of their division into cancers and sarcomata, varies with age. The growths of childhood are softer and more rapid than those of later life; and, besides this, they are more often painless, so that the apparent may be often much out of proportion to the real duration, since there may be no sign of the disease until the abdominal tumour becomes obvious. It is indeed evident that under most circumstances a growth so deeply seated, and one that usually does not seem to interfere with the function of the organ in which it is placed, is likely to remain in obscurity for so much of its early life that to every statement of the duration of the disease an uncertain time must be added.

In fifteen of the cases to which I have referred from hospital and private records, the time from the advent of the first symptom to death is stated with distinctness. This varied from eighteen days to four years:—

Duration of Malignant Renal Growths.

	Children 13 months to 4 years old	Adults 25 years to 58 years old	Total
From first symptom to death under 6 months	4	2	6
From first symptom to death from 6 months to 1 year . . .	2	4	6
From first symptom to death from 1 year to 2 years	—	1	1
From first symptom to death from 2 years to 3 years	—	1	1
From first symptom to death from 3 years to 4 years	—	1	1

Collected experience shows a similar distribution. Of nineteen cases among children, collected by Roberts,[1] the mean duration was nearly seven months: the minimum ten weeks, the maximum over a year. With adults twenty-one cases gave an average of two and a-half years, the extremes ranging from five months to seven years. Ebstein[1] gives the apparent duration in children at from five weeks to two years, in adults the time being variously extended to a maximum of eighteen years, for which length of time the disease 'was demonstrated to have lasted' in an instance in which it took its origin from a fall.

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[1] Roberts's *Renal and Urinary Diseases*, 2nd edit. p. 522.

Roberts observes justly on the frequently long duration of renal 'cancer,' and refers it in part to the duplication of the organ; but a more fundamental reason presents itself in the fact that renal cancer of clinical medicine is commonly not cancer, but sarcoma—a sarcoma sometimes of exceeding malignancy, but in other cases having the hard structure and slowness of extension which belongs to the more sluggish forms of the recurrent fibroid tumour.

Treatment of Malignant Disease of the Kidney.

With regard to the treatment of renal growths the first consideration must be of the feasibility of operation and cure. Modern surgery has demonstrated the possibility of the removal of one kidney without a necessarily fatal result. Malignant tumour of the kidney will surely kill if left alone; with the rapid growth of childhood this end is seldom long delayed after the detection of the growth. If excision could cure even a considerable minority a gain of life would ensue, even though the death of the rest should be hastened. Looking first at the question in the light of morbid anatomy, I must refer to page 735, where is a statement of the frequency of malignant growths in other parts of the body secondarily to those arising in one kidney—since I presume that no Excision.

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[1] Ziemssen's *Cyclopædia*, vol. xv. p. 684.

surgeon would think it right to extirpate the kidney were the operation to leave progressive and fatal disease elsewhere. It appears that of nineteen cases of malignant renal tumour which were examined after death, which had occurred in the natural course of the disease, there were but three in which the growth was confined to one kidney. Allowance must of course be made for the fact that in all these cases the disease was permitted, in the absence of operation, to extend to the utmost limits consistent with life. It is to be presumed that at an earlier date the proportion of secondary disease would have been less; nevertheless it is of grave significance. Looking now at the results of experiment, there have been up to this date (July 1882), as far as I know, eleven instances in which a kidney, the seat of a malignant tumour, has been extirpated, either by design or as the result of an operation begun with some other view. The results are briefly—six deaths as the immediate results of the operation, five recoveries. Thus it must be allowed that excision of a cancerous

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[1] I subjoin a brief enumeration of the cases of excision to which I have referred, for which I am mainly indebted to Mr. Barker's tables in the *Med.-Chir. Trans.* for 1880 and 1881, and to which I must refer for further particulars. Among the eleven cases mentioned are four in which the operation was undertaken on erroneous diagnosis—once for a cyst of the liver, once for a tumour which was thought to be either splenic or ovarian, once for ovarian tumour, once for renal calculus. The description of the tumour removed is probably not always to be accepted as the result of minute observation.

Enumeration of Cases of Excision of Kidney for a Malignant Tumour.

Operator and Date	Sex, Age	Place of Incision	Result	Condition of Organ
Walcot (America) 1861	M 58	—	Death in 15 days, from suppuration and exhaustion	Encephaloid, 2½ lbs.
Kocher (Bern) April 1876	F 35	Ventral	Death on 3rd day, from peritonitis. Operation not completed	Extensive sarcoma which involved meso-colon
Hueter (Griefswald) July 1876	F 4	Linea alba	Death under operation from haemorrhage	Perinephritic sarcoma, 5 lbs. in weight

kidney is practicable without such inordinate danger as to put it out of consideration. The question must turn on the permanence of the cure; and here our evidence is as yet imperfect. Lossen's case recovered from the operation, but we have no further knowledge of the patient. Martin's patient was in good health two and a-half years afterwards; Byford's two years and four months afterwards. Jessop's patient died under a return of the disease, within a year; Adams's patient in about six weeks; both with disease of the same nature, in the lumbar glands and elsewhere. Thus, in the whole number we have but two cases, or possibly three if we include Lossen's, in which the ultimate result was favourable. It is clear that both cancer and sarcoma of the kidney are highly malignant; neither are as a rule discoverable until

Operator and Date	Sex, Age	Place of Incision	Result	Condition of Organ
Jessop (Leeds) Jan. 1877	M 2½	Lumbar	Temporary recovery. Disease recurred probably in lumbar glands. Died about 9 months after operation	Malignant tumour
Kocher (Bern) Dec. 1877	M 2½	Ventral	Death on 3rd day, from peritonitis	Large adeno-sarcoma
Byford (America) March 1878	F 39	Linea alba	Recovered rapidly. Patient in good health, July 1880	Encephaloid, 4½ lbs.
Martin (Berlin) Dec. 1878	F 53	Ventral	Complete recovery. Known to be in good health 2½ years afterwards	Malignant new growth weighing 28 oz.
Czerny (Heidelberg) Jan. 1879	M 50	Ventral	Death in 10 hours, from shock	Soft spongy mass left *in situ*
Lossen (Heidelberg) Aug. 1879	F 37	Linea alba	Recovery perfect. Later history not known	Angio-sarcoma 5 times size of kidney grew from its surface
Barker (London) Dec. 1879	F 21	Linea alba	Death in 45 hours, from pulmonary thrombosis	Two-thirds of organ converted into encephaloid
Adams (London) March 1882	M 30	In loin, parallel with last rib	Recovered from operation, but died about 6 weeks afterwards, from recurrence of disease in lumbar glands	Carcinoma

they have attained the bulk of palpable abdominal tumours, and reached therefore a comparatively advanced stage; and on the whole I doubt whether a permanent cure is to be anticipated in a sufficient proportion of cases to justify the large risk of immediate death which the operation entails.

Palliative treatment

The palliative treatment of malignant renal growths has to be directed for the most part towards the relief of pain and the control of hæmorrhage. The use of morphia by the mouth, or, better, by the skin, is of the first value; its systematic use will sometimes prove of the greatest comfort. A smaller measure of relief, with a complete absence of any injurious effect, is to be obtained from the application of plasters of opium or belladonna, or the aconite liniment. Sometimes in connection with renal or vesical growths a burning sensation over the kidney or ureter is a source of distress; for this, as observed by Prout, an ice-bag is the best remedy. Hæmorrhage, when present, is usually the symptom which most urgently seeks relief. That the bleeding is from a growth may be more certain than either the position of the growth or its nature; but, whether from the kidney or bladder, whether compact or villous, internal astringents are often attended with advantage. Striking and speedy results have indeed sometimes ensued upon such remedies, where, from the case having presented itself only in its clinical phase, it has been impossible to define it with certainty further than as one of a bleeding growth.

I have seen the best results from iron alum, tannate of alumina, gallic acid, ergot, and the wych-hazel. Gallic acid and ergot, given together, have been followed by the complete arrest of profuse hæmorrhage, presumably of villous origin, while I have often known bleeding, evidently from malignant disease, to be conspicuously controlled by the tannate of alumina or iron alum.

Cases.

Frequent passage of renal calculi; subsequent development of a malignant sarcoma in the affected kidney; its encroachment upon the spine, with resultant paraplegia; spasmodic dyspnœa the result of depositions in the lung; post-mortem examination.

In the autumn of 1871, I was consulted by Colonel H——, who had passed some small calculi. He was then fifty-five years of age, tall, thin, wrinkled, and with a faintly bronzed complexion like a returned Indian, which, however, he was not. He had led a fashionable life, and spared himself none of its fatigues. He came of a gouty stock, but had not had gout. It appeared that from the year 1863 to 1871 he had had repeated attacks of renal colic with hæmaturia, and had passed at least a hundred stones whose range of size was about that of shot. Six weeks before I saw him he had lost blood with the urine somewhat copiously, and had since had much dull pain and sense of weight about the left lumbar region, without any affection of the testicle or thigh.

September 1871.—Examining the abdomen, no definite tumour or localised tenderness could be felt, though on the left of the umbilicus, in front of the position of the left kidney, there was some increase of resistance and diminution of resonance. In the lumbar region nothing unnatural could be discovered.

His pulse was 68, the tongue somewhat coated; he complained of indigestion and acidity.

The urine was acid. It deposited a bulky cloud of translucent mucus, and contained albumen coagulating to a tenth. Specific gravity 1019·4. Under the microscope were many crystals of oxalate of lime, but no casts. A single small calculus was obtained which had been passed some time ago; it consisted of oxalate of lime.

He was urged to live plainly, to drink distilled water, and take nitro-hydrochloric acid and strychnia.

November 28, 1871.—Two months after he was first seen he had, after travelling, another attack of rather profuse hæmaturia with dull pain in the left loin.

Shortly after this he went to Nice, where he passed the winter, with little disturbance of health excepting indigestion.

April 26, 1872.—He came back looking much as before, with the same dull pain in the left lumbar region, and more particularly in the belly, to the left of and rather above the umbilicus. The urine was now lithatic ; it contained only a trace of albumen : in this respect, however, it varied much—two months later it contained as much as a fifth. Crystals of oxalate of lime were often found, and generally a light cloud of mucus : never casts.

His health, however, was not permanently broken. He visited Vichy with apparent advantage ; and, avoiding horse-exercise, living plainly and temperately, drinking distilled water, and taking tonics and mineral acid, the symptoms remained in abeyance, insomuch that at intervals he was little different from his former wont. So he remained until the winter of 1873–4, when he successively visited Nice, Pau, and Biarritz, thinking that neither agreed with him. His lumbar pain became more troublesome, he suffered from want of appetite and constipation, and passed small calculi in great numbers.

March 10, 1874.—On his return he brought me some of these small concretions, which might have been mistaken for large mustard-seeds. They contained both oxalate of lime and uric acid, the latter being superficial. Of these he had for some time discharged not less than half-a-dozen every morning.

He had much pain about the left lumbar region ; looked haggard and ill ; and had lost his appetite. The bowels were confined, and the tongue coated, and on examining the abdomen, the sense of resistance and dulness on percussion were somewhat more marked than formerly. The urine was lithatic, and contained, as before, albumen and mucus.

March 18.—The pain in the left loin, which was deeply tender, now increased, and became exasperated by movement, so that he could only crawl up and down a few stairs with difficulty, and became virtually confined to his bed. There were slight twinges in the line of the ureter and in the left testicle, which was somewhat retracted, but the most severe pain was behind, near the junction of the sacrum with the ilium.

The albumen and mucus, plentiful three days ago, had now ceased from the urine, pointing to the inference that the exit of the left kidney had become occluded by a calculus, and that the urine was the product only of the right, presumably healthy, organ. This, together with a quickened pulse and febrile condition, led to the belief that the cause of the disturbance was the impaction of a stone, with consequent distension and inflammation of the cavity of the left kidney.

March 26.—I now had the advantage of a consultation with Sir W. Gull, who joined me in the subsequent management of the case. The muscular resistance and tenderness about the left hypochondriac and umbilical regions were more marked, but not such as to prevent the detection through the abdomen of a deep swelling in the position of the left kidney. This, together with the haggard and embrowned aspect of the patient, suggested to Sir W. Gull the idea of cancer; but at our next meeting (April 1), taking into consideration that the patient had looked much the same for some years past, that there was presumptive evidence, in the sudden stoppage of the albuminous and mucous discharge, of blocking of the left ureter, and that the bodily temperature was exalted, now ranging between 99° and 101°, we concurred in the original view, that the disturbance was inflammatory and consequent only upon stone. Rest, opium, salines, and warm applications were used, with much mitigation of the pain.

The febrile condition, with quickened pulse and raised temperature, continued for about a fortnight, and even to the end was occasionally manifest. The evening temperature was frequently between 101° and 102°, the morning always lower.

April 3.—On April 3 he suddenly found that he could not pass water. Mr. Rouse, who introduced a catheter, ascertained that the failure was not from obstruction, but paralysis, which remained until death, no urine being henceforth voided but through an instrument. Three days after the loss of vesical function the urine was found to be ammoniacal, and to contain ropy mucus, which conditions persisted and increased.

Almost simultaneously with the paralysis of the bladder, the sphincter ani lost its power, insomuch that the motions passed without control and almost without knowledge.

April 4.—The left leg, almost immediately afterwards, became abnormally sensitive, then by almost imperceptible degrees lost motor power, and finally, though not until much later, its sensibility. The right leg starting about a week subsequently, followed the same course, so that by the middle of April complete paraplegia existed.

April 20.—Bed-sores in the meanwhile were forming and spreading. As careful an examination of the spine as was practicable in his supine position revealed no tenderness, nor was there pain there.

The spinal lesion was regarded as the result of the extension of disease from the kidney, and it was surmised that the extension might be by that means—whatever that means may be—which occasions what has been termed 'urinary paraplegia,' and has been regarded as reflex.

The powers of life gradually failed with the intercurrence during the last few days of severe sudden attacks of dyspnœa, unaccompanied by any change in the lungs ascertainable by the stethoscope. Death occurred by slow asthenia, consciousness remaining to the last. He died on May 8, after a course of suffering unusual alike in its complication and its severity.

After death it was found that the central part of the left kidney was entirely replaced by a globular tumour about three inches in diameter, which reached from the pelvic membrane to the capsule, and had destroyed all the central portion of the gland, leaving but a small part at each end, which together amounted to about a fourth of its bulk.

The tumour was hard, dry, and fibrous, like scirrhous cancer, which at first it was supposed to be. The mass was interspersed with small collections of hæmatin crystals, and specks of cretaceous matter, scarcely large enough to be visible, but tangible to the knife. The bulk which was thus composed was separated from the capsule by a layer, about a third of an inch in thickness, of soft recent formation resembling encephaloid, which was abruptly marked from the inner and older growth.

Under the microscope, in the fresh state, the tumour displayed a dense arrangement of intersecting fibrous tissue, together with elongated cells in section. After hardening it proved to consist of a vast entanglement of spindle-cells, among which small round nuclei could in some places be seen. The spindle-cells were sometimes arranged concentrically around small cavities containing shapeless débris. In the softer parts of the growth these cavities were relatively large, and the separating fibroid structure reduced to little more than a substantial network; but no epithelioid or other cells could be discerned in any of the cavities, and it was apparent that the growth, however malignant, had the anatomical character rather of a spindle-celled sarcoma than a cancer, as the term is at present employed. (See woodcuts, pp. 748 and 749.)

The lining of the pelvis was not involved, though the cavity was much compressed in its central part.

The mucous membrane was much congested, as also was that of the corresponding ureter. The last half-inch of this duct, in connection with the bladder, was intensely vascular, as if recently traversed by a calculus.

The lumbar glands opposite to the diseased kidney were converted into a mass of soft growth resembling encephaloid, which had eroded and become embedded in the adjacent vertebræ. The bodies of these vertebræ had become infiltrated with this material to such an extent that several were almost destroyed : the body of the last dorsal vertebra was completely cut in two, so that the finger could be passed through a jagged hole, from the erosion in front into the spinal canal.

The sheath of the spinal cord was covered for about the space of two inches opposite the affected vertebræ with a thick layer of soft inflammatory exudation, by which the cord in this situation must necessarily have been compressed, though it did not seem to be altered in other respects. The interior of the sheath was natural.

The right kidney was increased in size to nearly twice its ordinary bulk; the secreting structure was natural in character, and the increase was evidently due to the hypertrophy of compensation.

The bladder was much inflamed. It contained a smooth ovoid calculus of the size of a small bean.

The liver and the lungs contained numerous soft vascular masses resembling encephaloid, which varied in size from that of a marble to that of a chestnut.

Comments.—There are several points of interest in this characteristic case. It was sufficiently clear that the calculous condition had long preceded the malignant growth; that such growths are often the ultimate result of irritation by stone is a fact which becomes more and more evident with increasing experience. The paraplegic symptoms were the necessary result of the encroachment of the growth upon adjoining structures, and in no way connected with the hypothetical reflex paralysis which is sometimes attributed to urinary disorder. The tumour, as such are apt to be, was a malignant sarcoma, and not what is somewhat arbitrarily defined as cancer. Diagnostic interest lies in the latterly continued high temperature, which during life was erroneously interpreted: it was taken as an indication that the local mischief was rather inflammatory than malignant. A malignant growth appears seldom to cause elevation of temperature, but that such a growth may do so when it is progressive and destructive, is one of the practical lessons of this case.

Malignant sarcoma of the left kidney and lumbar glands, severance of the spinal column by extension of the disease, with temporary crepitus as from fracture, consequent paralysis chiefly of the bladder, post-vesical abscess discharging into the rectum, death from secondary pneumonia.

Henry Tempero, a gardener, thirty-four years of age, came under my care in St. George's Hospital, complaining chiefly of pain in the back.

Six months before, while engaged in bedding out plants, he had to lift a great many heavy boxes: after lifting one heavier than the others, he felt a pain in his back, and was told that he had partially ruptured one of the muscles there. The pain began over the position of the right kidney, and there continued not acutely, but constantly, for two months, when, according to his statement, it transferred itself to the corresponding position on the left side, and there grew worse, until, a month before admission, he had to give up work. The pain had latterly been confined to the lumbar region, save that for one night it passed down the inner side of the left leg to the knee.

On admission (November 4, 1874) he had no look and no feeling of illness except what was localised to the left side of the spine, to the position as it appeared of the kidney; here pain was unceasing, dull when he was at rest, made acute by movement. He was least uneasy when lying flat upon his back, or partly upon the left side; gentle pressure upon the loin relieved the pain, and he often found relief by placing a pillow under the painful side. The urine contained no trace of albumen, no blood-corpuscles, nor any abnormal deposit save a few crystals of uric acid.

No lumbar swelling could be felt, nor, by ordinary examination, any in the abdomen, but under chloroform, which the resistance of the abdominal muscles made necessary for satisfactory handling, a rounded lump was felt on the level of the umbilicus and just to its left, lying quite at the back of the abdomen, apparently in connection with the left side of the vertebral column or the adjacent part of the left kidney. The mass moved with pulsation, but itself appeared to be unyielding to pressure; it suggested to the touch the dimensions of about an inch each way.

It was next found (November 27) that he was unable to pass water; a catheter met with no obstruction; and that the retention was due to paralysis was further shown by the need for extraneous pressure to empty the bladder.

Two days afterwards a considerable quantity of unaltered pus was passed with the motions. A surgical opinion was requested as to the state of the spine and pelvis; in neither could any disease be discovered. The pus continued to escape, to the amount of an ounce and a-half daily; and on December 7 a shreddy slough three inches in length, which looked like a piece of bowel, was discharged.

The bodily temperature was regularly noted: in the morning it varied from 97·6° to 99·4°, in the evening from 98·6° to 101·0°.

The next phase in the case was the discovery by my house physician (Mr. Mackinlay) of a distinct crepitus like that of broken bone, when the spinous process of one of the lower dorsal vertebræ—which was unnaturally movable—was moved from side to side. The sensation was distinct and unmistakable; it lasted for two or three days, and then, though the bone was still movable, it no longer grated. The patient was now rapidly losing flesh and strength. On January 12 he was noticed to be feverish, with a temperature of 102°. Some degree of dyspnœa led to the detection of dulness, tubular breathing, and ægophony about the base of the left lung, after which he rapidly sank, and died on the 17th.

At the *post-mortem* examination it was found that the left kidney was larger by one half than the right, the enlargement being due partly to an isolated mass resembling encephaloid cancer, which projected abruptly from the lower extremity of the organ, making a prominence about the size of a chestnut, and partly to a number of smaller nodules varying in size from a hazel-nut to a pea, which were scattered through the adjacent part of the cortex.

Examined in section, the growth proved to be a monstrous development of the interstitial tissue of the kidney, which, according to present custom, would receive the name of sarcoma. (See woodcut, p. 745.) Localised tracts of this tissue were enormously swollen with nuclei multiplied and magnified. The Malpighian bodies were surrounded and often altered in shape by pressure. This change passed without abrupt severance into collections of enormous nucleated cells, more or less rounded, but some angular, which lay in a delicate intercellular network, each cell in its own mesh, having the typical appearance of the large round-celled sarcoma. The whole organ was vascular, the pelvis and ureter natural. Surrounding the renal artery, and in front of and adhering to the aorta, was a mass of infiltrated glands three inches from above downwards, and an inch and a-half from before backwards. The nodulated mass thus formed was closely applied to the hilum of the kidney on one side, and on the other to the aorta and spinal column. The bodies of the three last dorsal and first lumbar vertebræ were invaded by the growth, which had to a great extent replaced the cancellous tissue of the bodies of those bones. The body of the eleventh dorsal in particular was so completely cut in two that the upper and lower articular plates could be moved independently, being connected only by a soft new growth. This had extended into the spinal canal, and was found as a thin soft layer upon the outer surface of the dura mater from the fourth dorsal to the last lumbar vertebra. Opposite the third lumbar, likewise external to the sheath, was a lump of the same formation as large as a filbert. The inner surface of the sheath was natural, but upon the surface of the cord opposite the tenth dorsal vertebra was a nodule the size of a large pea, which upon section was seen to have deeply invaded its substance.

The right kidney and its surroundings were natural; it weighed six ounces.

The recto-vesical fold of peritoneum was converted into the cavity of an abscess, evidently of some standing, which communicated with the rectum by an ulcerated opening half-an-inch in diameter.

Half-a-pint of semi-purulent fluid was found in each pleural cavity; the membrane in each instance was thickly coated with lymph, and the lower lobe of each lung was in a state of red hepatisation.

Comments.—Whether the disease began in the spine or the kidney is a question to be considered; but the early position of the pain, the presence of renal or circum-renal tumour before the occurrence of any spinal symptoms, and the localisation of the vertebral disease to those bones which are in apposition to the kidney, and are, as is shown by the preceding case, precisely those which are apt to participate in renal growths, warrant the supposition that the kidney was the first seat of the change.

Small as the tumour was, it is worthy of notice that the use of chloroform enabled it to be clearly detected, and its nature and position correctly determined during life. Although the glandular swelling was considerably larger than the renal, it was probably secondary to it. The progress of the disease through the vertebral column gave the leading characters to the case; the crepitus, arising as it did between the upper and lower fragments of the eleventh dorsal vertebra, was a peculiarity which I am not aware has been noticed in any other instance of spinal disease. The cause of the abscess between the bladder and rectum was not made evident by the *post-mortem* examination; the circumstances point to the possibility that it may have been connected with some minute extravasation of urine in connection with the paralysis of the bladder, but this must remain uncertain, as no rupture or ulceration of the bladder was discovered. The final pleuro-pneumonia was probably of pyæmic origin, so that death was due to the abscess rather than directly to the tumour.

Malignant renal tumour with secondary formations in the lung. Latency of primary growth, but marked declaration of those of subsequent origin.

On January 3, 1877, I was called by Dr. Clifford Allbutt of Leeds to confer upon the case of a manufacturer living near that town, who had been obscurely ill for some time. The patient, whose age was fifty-two, had, though the fact was lost sight of until after his death, passed blood with the urine in the year 1873, the symptom lasting more or less for about three weeks. In the following year he did so again for a shorter time. He remained, however, without any marked impairment of health until 1875, when he became what was thought dyspeptic, and about the beginning of 1876 began to lose flesh and strength without obvious reason. In this year he lost about two stones in weight, and that without any pyrexia, tangible discharge, or evident process of loss. Dr. Clifford Allbutt, his occasional, and

Dr. Carter of Chapel Allerton his constant, attendant, found from time to time that the urine was slightly increased in quantity, and that it presented now and then, but not always, a faint albuminous line with nitric acid. No morbid deposit was detected in it. There had been no dropsy, vomiting, headache, nor any symptom which could be attributed to uræmia ; and Dr. Allbutt assured me that the pulse was soft, the heart free from hypertrophy, and the sight unimpaired—all negative witnesses as to the existence, to say the least, of any such degree of granulation of the kidney as to influence the system, and cause the breakdown of health. As a superaddition to the symptoms which have been mentioned, the patient for the last few weeks had been troubled with paroxysms of cough, which he described as like those of whooping cough, spasmodic, violent, and seldom, occurring only three or four times in the day, incited especially by going upstairs, or any bodily exertion. He had no change of voice, nor any symptom which could be regarded as laryngeal, though he himself was of a different opinion, spoke of a sensation at the top of the thyroid cartilage, and insisted on being examined with the laryngoscope, it is needless to say with a negative result. Thus, without any symptoms which seemed to furnish reason or excuse, without noticeable impairment of any function, with a quiet pulse and a normal temperature, he took to his bed. As he presented himself to my observation, he was a thin, elderly man, lying in bed, as it seemed, rather from choice than necessity, with a full voice, a cool skin, a nearly natural though somewhat quick pulse (rate 90), and no obtrusive sign of illness. More particular examination showed, as indeed Dr. Allbutt had already discovered, that there was a small rounded substance to be felt in the right hypochondrium, exactly in the position usually occupied by a slightly enlarged spleen, immediately below the ribs, only to be reached by deep pressure. This was neither painful nor tender, though, as I afterwards learned, it gave pain to the patient the day after the examination. It would have escaped notice altogether, but for the somewhat searching examination to which he was subjected. Beside this, the right apex of the lung had a trifling deficiency of resonance as compared with the left, no abnormity of respiration existing here or elsewhere, and a swollen gland about as large as a small chestnut, which the patient was sure was of recent date, was to be felt and seen at the root of the neck on the right side immediately above the clavicle. A faint soft murmur, heard with the systole over the pulmonary artery, completed the evidences of disease which the patient presented in person; it is to be added that he had coughed up one or two small curiously hollow sputa, which were white and hard externally, softer within, and of the size of peas, which, but for their cavities, they would have much resembled.

Notwithstanding the traces of albumen in the urine the granular kidney, as the leading mischief, was put aside by the softness of the pulse together with the absence of cardiac hypertrophy, and of all signs of uræmia. The total absence of pyrexia and of the pulmonary evidences of phthisis put aside tubercle. The wasting, not otherwise explicable, together with the recently enlarged gland and the other circumstances of the case, led us to express without doubt the belief that he was the subject of malignant disease; but we were unable to localise it otherwise than by the cough, which we held to point to its presence within the thorax. This view was confirmed by a subsequent examination of one of the peculiar sputa, which was found to contain in its soft centre flat plates of epithelium, evidently derived from the respiratory tract, while the outer shell contained a number of small cells or large nuclei, suspiciously like a sarcomatous growth.

It is to be added that the urine, though containing only a trace of albumen, displayed under the microscope swarms of casts, mostly of small size and coarsely granular texture.

For what follows, as for much that has preceded, I am indebted to Dr. Clifford Allbutt and Mr. Carter. The patient, learning something of the issue of our deliberations, lost all heart, refused food and medicine, and sunk, without complaint or pain, save that he had occasional paroxysms of cough, and so died on the last day of January.

Mr. Carter examined the body, and Dr. Clifford Allbutt subsequently some of the organs. The tumefaction in the left hypochondrium was the left kidney swollen by apparently encephaloid growth to the size and shape of a Marie Louise pear. The right kidney was normal in texture, though somewhat increased by compensative hypertrophy.

The lungs were studded with soft deposits of the same nature, apparently secondary to that in the kidney. These were particularly abundant about the free edges of the lungs. The largest mass, about the size of a walnut, was found in the right apex in the position of the dulness noticed during life. This mass was closely attached to the swollen gland above the clavicle, which was infiltrated with the same material.

The heart and all the other organs were natural.

Comments.—I had no opportunity of examining the growth with the microscope, and cannot therefore give it a pathological place. The negative characters of the case were the most striking—the insidious failure of health, with no localised symptom until near the end, when the lungs became secondarily involved, and the spasmodic cough was produced. This complication proved of paramount importance, and gave a more unequivocal intimation of the nature of the disease than was otherwise obtainable. The peculiar hollow sputa were more than suggestive of a growth surrounding in places the respiratory tract; the soft epithelial centres being the bronchial secretion, and the outer nucleated structure detached portions of the growth.

The casts in the urine sufficiently indicated that the glandular structure of the kidney was not sound; but it was correctly inferred, from the absence mainly of cardio-vascular changes, that there was no such degree of granular disease as to account for the state of health, or be of practical importance.

The interest of the case lay mainly in its latency.

CHAPTER VIII.

TUBERCLE.

PATHOLOGY.

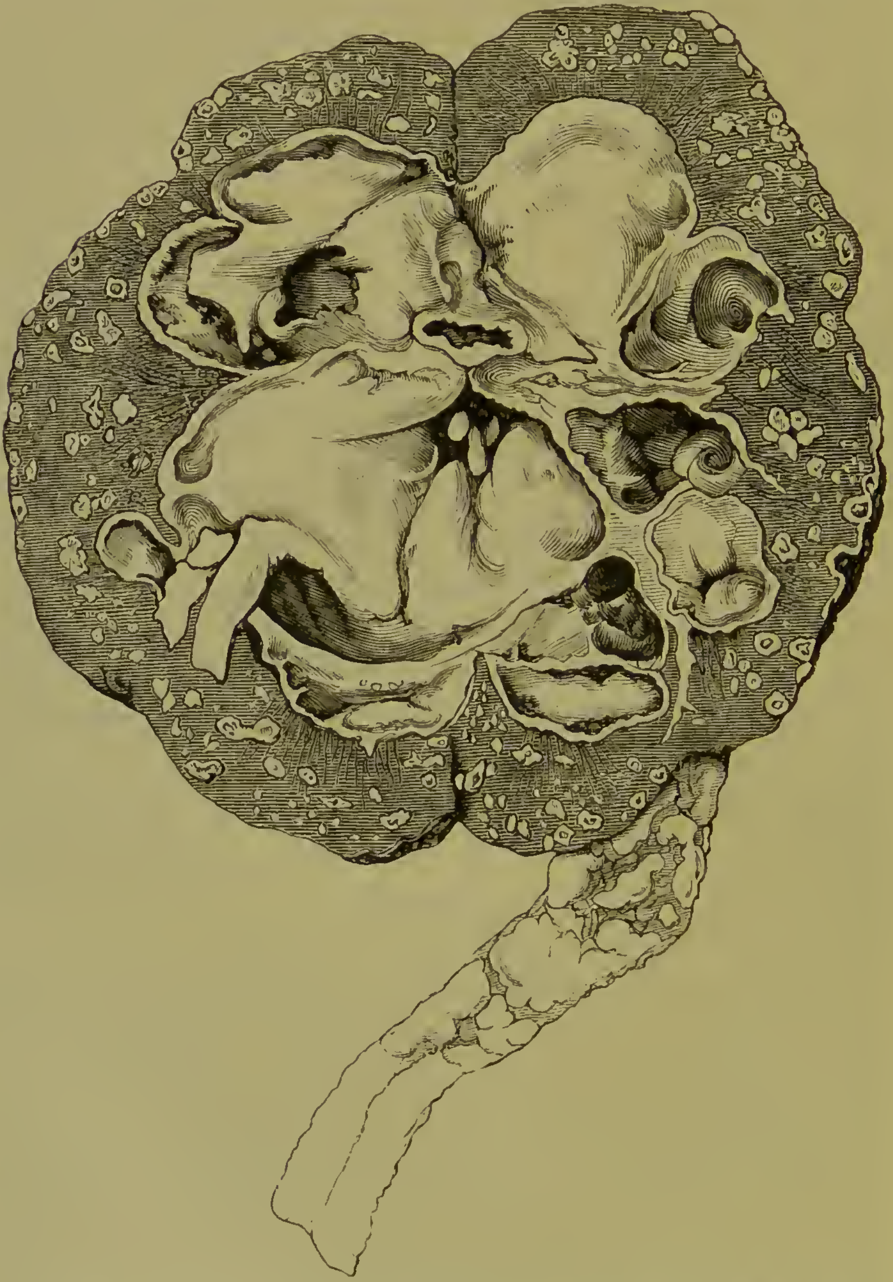
Naked-eye appearances.

LOOKING at the kidney itself, and first at the manifestations of disease which are evident to the naked eye, tubercles and tubercular concretions present themselves in it of every size and grade. These range from delicate, scarcely visible, grey tubercles of the finest miliary dimensions, up to caseous and softening masses which may be as large as peas, or nuts, or even larger than to be so compared, and which may be so numerous as to present a considerable bulk in comparison with what is left of the renal tissue. It is not practicable to make any definite distinction between the miliary and the caseous, the miliary become caseous as they enlarge, so that, though in some cases there may be only one or only the other, yet they are continually intermixed and inseparable, as different results of the same process.

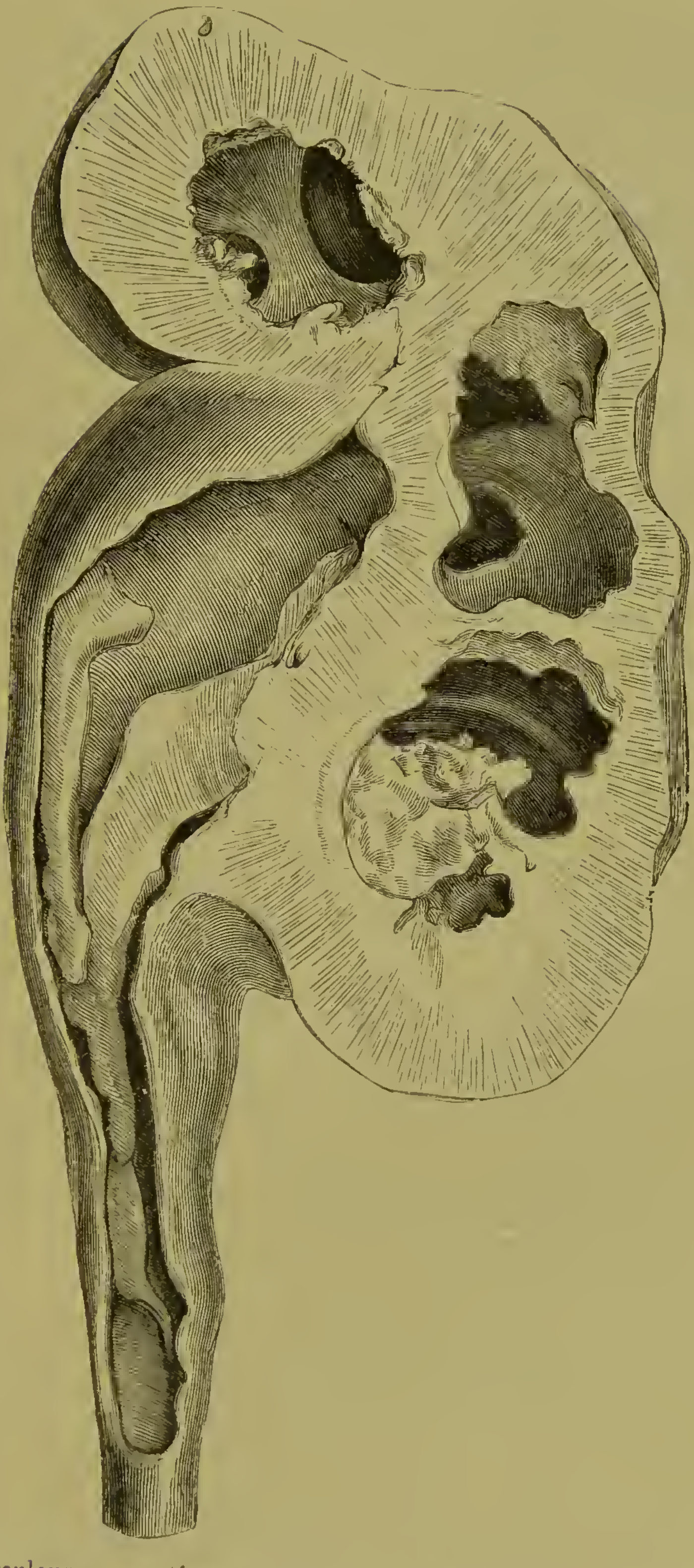
The growths, especially when miliary, are more often found in the cortex than in the cones, though often in both. They are commonly distributed apparently at random through the cortex, with no further bias than one towards the surface, upon which they display themselves in circular outline while they push inwards in somewhat conical shape. Occasionally it is to be discerned that their distribution is determined by that of some arterial branch. Where recent they are often surrounded by zones of injection almost like emboli or pyæmic abscesses. When of larger bulk, as considerable caseous masses they may soften in their centres and form abscesses, which may be

Renal vomicæ.

long locked up, or may possibly escape by the surface or through one of the cones into the pelvis. But when such discharge occurs it is more often from the deposition of tubercle in the cones themselves than by way of exit to an abscess of cortical origin. Thus the occurrence of tubercle in the pyramids, though less frequent than in the



Tuberculous kidney. Tubercles, which in many instances have begun to soften, scattered throughout cortical tissue. Pelvis and ureter much thickened. (From a drawing in St. George's Hospital.)



Tuberculous excavation of kidney with membranous pyelitis. A separable false membrane is seen lining the infundibulum. (From a preparation at St. Thomas's Hospital.)

cortex, has especial interest in relation to the symptoms of the disease. These portions of the organ are apt to display small tubercular masses at their apices or to be extensively, or some even completely, replaced by caseous tubercle or abscesses of tubercular origin. The cone splits between its converging lines, and the pus thus finds its escape into the pelvis where the mammillary process points. Often the opening is delayed, and a considerable globular cavity formed in the place of the cone, before the narrow orifice has been formed; thus the vomica may have the shape of a flask or bottle, a rounded cavity discharging by a narrow neck. Many pyramids may be thus excavated, and the kidney so converted into a mere cyst, with many septa, each septum or partition being the condensed remnant of the portion of cortex between adjacent cones, while the pelvis is the common vestibule with which all the chambers communicate. The process may extend until the outer cortex is so excavated, and so much transformed by the concurrent processes of glandular atrophy and fibrous increase, that it also may be reduced to little more than fibrous tissue, and the whole organ to a chambered shell. The process of transformation is sometimes aided by stoppage of the ureter, and accumulation of the renal contents, as a consequence of which the organ may be distended as well as excavated. The organ may at last shrink, and become quiescent, a partly caseous and partly calcareous mass, or possibly one wholly calcareous, remaining embedded in its fibrous case. It is to be observed that as this process goes on, fat accumulates upon and about the organ.

Ultimate results.

The foregoing sketch has been drawn from those cases only in which the tuberculous nature of the renal disease has been attested by the occurrence of tubercle elsewhere. Among them were many in which the organ had been so completely transformed into a bag of pus, or of something resembling wet plaster of Paris, or chalk, that neither renal tissue nor tubercle remained, and it would have been impossible but for the extraneous testimony to make sure of the tubercular origin of the disorder. Several cases of similar destruction of the kidney occurred without either remaining tubercle in the organ, or any external to it, to declare the nature of the disease; it is probable that many such were tubercular, as indeed they were regarded; but since renal suppuration of other origins may produce a similar result, each such instance may be attended with doubt.

Micro-scopic particulars.

Proceeding with the help of the microscope to further detail, it was found that the grey miliary and the yellow caseous tubercle differed in size, distribution, and standing rather than in kind. To take the small miliary nodules as typical of the rest, these may be first noticed as small circumscribed masses of interstitial growth, consisting of minute, ill-defined nuclei. Though less definite in structure, this resembles in situation the common fibrosis of the kidney, accumulating around the Malpighian bodies, and swelling the reticulum. These formations may be scattered apparently at random in the cortex without any indication of what determines their position. The next stage is the transformation of the central part into a yellow rounded mass of indefinite structure, which has lost all trace of organisation, and tends to crack or break in the centre, while it is surrounded by a zone of the same ill-marked and indefinite fibrosis as formerly constituted the whole. In some instances of recent and rapid growth, the injection, though less intense, is not very unlike that which surrounds an abscess. The larger masses, connected possibly with arterial branches of considerable size, may display their anatomical relations with graphic distinctness, one sometimes looking like a bead upon a thread, or, should the section so determine, like a plum upon a stalk.

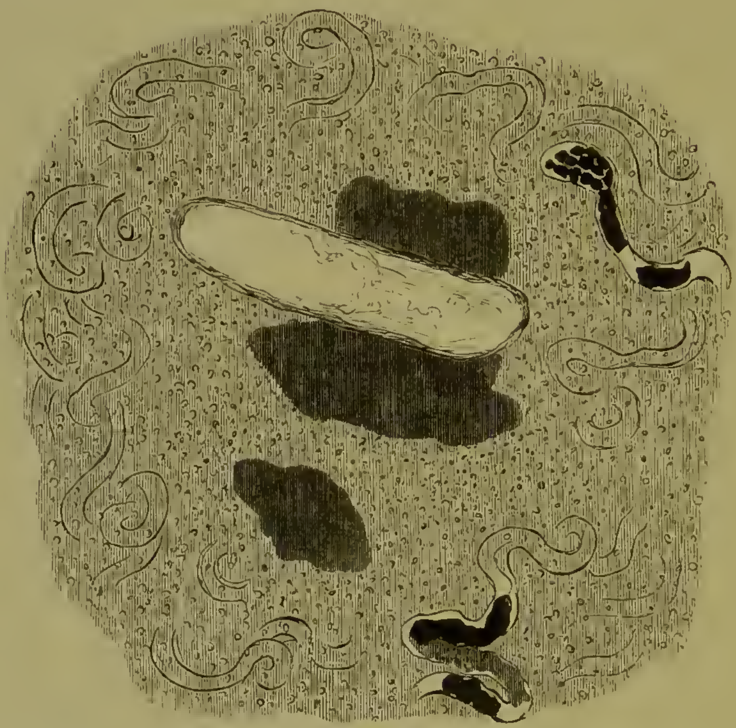
Relation of tubercle to blood-vessels.

The annexed woodcut shows the yellow amorphous mass in immediate contact with the vessel, the nucleated growth outside it and around all the renal structures, with evidence of localised nephritis in the obstructed condition of some of the tubes. Another outline shows also the

Obstruction of tubes.

stalk-like arrangement produced by the section of the vessel in the midst of the mass. The tubal obstruction is not the only, or even the chief, inflammatory change which the kidney undergoes in consequence of the tubercular action: interstitial nucleation, or fibrosis, is often conspicuous, not only in the immediate neighbourhood of the tubercles, but also somewhat widely distributed. Sometimes the common interstitial nucleation is connected inseparably with the tubercular, as if they were but different parts of the same process.

Interstitial fibrosis.

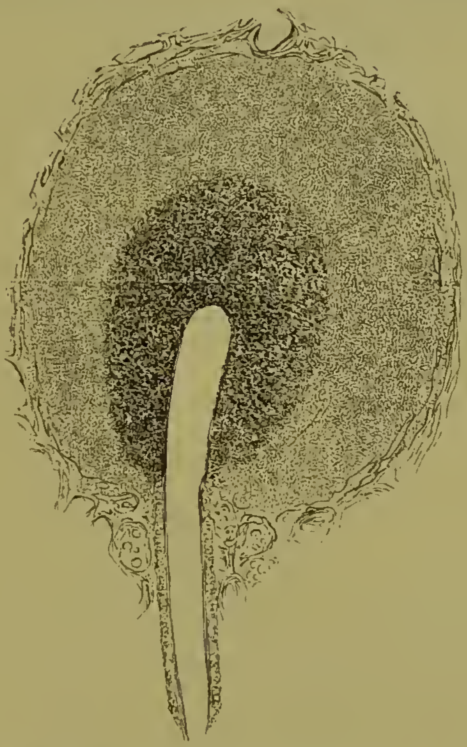


Acute general tuberculosis of kidney in a child. Caseous mass in contact with blood-vessel; nuclear growth around; few distended tubes on circumference. (From cortex.)

The tubercular masses, when they occur in the cones, are sometimes collected into wedge-shaped groups like the disposition of emboli or pyæmic abscesses, and the resemblance may be increased by a circumference of vascular injection.

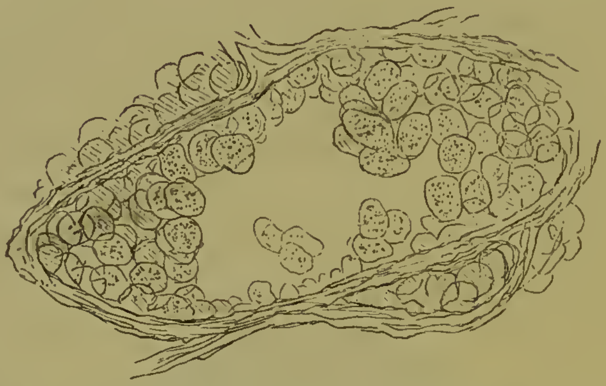
Large-celled growths in tubercular shape.

In one instance which came under my observation, the minute anatomy proper to tubercle was remarkably intermixed with that of a large-celled growth. The kidney to the naked eye had ordinary tubercular characters. There were several collections of half-caseous pus in the cortex, which were regarded as suppurating tubercle; and their tubercular character was confirmed by the presence of an apparently tuberculous ulcer in the bladder, and an abundance of miliary tubercles in the lungs. Under the microscope the kidneys displayed in parts the nuclear and caseating appearances which usually belong to tubercle, but in other parts were aggregations of very large nucleated cells lying together like the cells of cancer or of an alveolar sarcoma. In some places were fibrous bars or partitions, which divided groups of cells in mutual contact; elsewhere—and this was most striking, as forming the lining of one of the considerable abscesses—these cells were heaped together without any further evidence of reticulum than a few ragged shreds protruding from the edge. If we regard this as a concurrence of two growths, as the

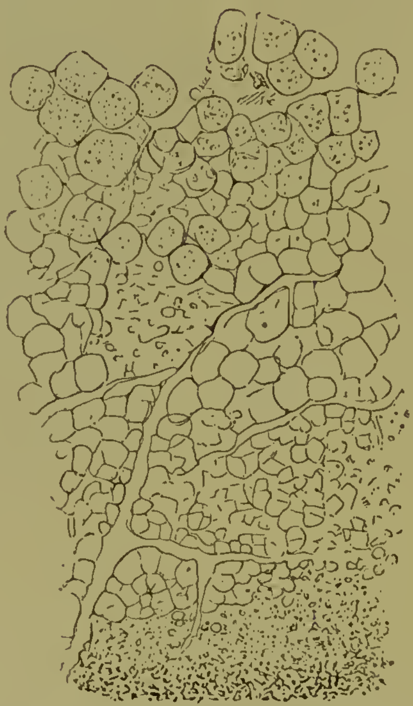


Mass of tubercle upon an artery cut diagonally so as to give stalk-like appearance. Amorphous matter next vessel, nuclear growth outside. (From cortex of kidney of same subject as preceding.)

mixed characters would suggest, we have to observe that the sarcoma broke down with suppuration, certainly not a habit with that growth. On the other hand, if the large cells were tubercular, they were at least exceptional in that relation.



Large cells within a fibrous reticulum from a kidney which to the naked eye was tubercular. (From a woman whose case is also referred to in woodcut at p. 808.)



From same case as preceding woodcut. Section of the wall of tuberculous (?) cavity. The large cells above form the wall of the cavity; the smaller below are in contact with the renal structure.

The disintegration and excavation of the tubercular masses is an important step in the destructive process.

These, having attained a certain size, break down in their centres and form cavities which, so long as they are confined to the cortex, are more or less circular; but on reaching the cones they are apt to elongate in pyriform shape with the narrow end toward the pelvic cavity, into which they eventually discharge. A cavity in the lung empties itself by a bronchus; a cavity in the kidney should by analogy relieve itself through a renal tube, or a channel formed out of one. But, as far as I have been able to observe, this is not the case. Collections of *débris*, somewhat, but not much, larger than the sections of tubes, are sometimes seen to be surrounded with a membrane which might pass for the wall of a tube, but I have never been able to discern an epithelial lining upon it, or to satisfy myself that such apparently tubercular cavities were really of tubal origin. Enlarged and obstructed tubes are sometimes seen in the neighbourhood of tubercular excavations, but I have never been able to trace a continuity between them. Thus it would appear that the renal vomicæ find exit otherwise than by the renal ducts. Formation of cavities;

It has been said that the cavities, which are more or less round in the cortex, tend to become elongated should they touch the cones. In the cones the whole structure is disposed in nearly parallel lines, between which it tends to yield under encroachment like wood before the wedge. The lines of cleavage converge upon the apices of the pyramids, and it is here or hereabout, often by a constricted channel, that the renal vomica finds its exit. When it happens, as it often does, that the growth of tubercle begins in the cone, its discharge into the pelvis is of course the more ready. The mucous membrane of the pelvis, ureter, and bladder may be affected by tubercular disease, together with the kidney, either independently or consequently. When the kidney has been excavated so as to discharge, as it usually does, into the pelvis, the mucous membranes in the line of exit are so constantly affected that concurrent evidence of cystitis is of the

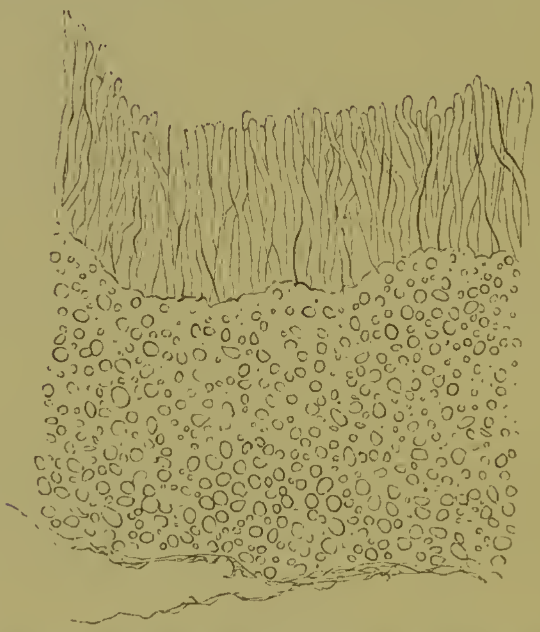
their mode of exit.

Pelvis and ureters.

first importance in leading to the diagnosis of tubercular disease.

The pelvis of the kidney in such circumstances is commonly injected, inflamed, thickened, even into a stiff caseous layer, or variously ulcerated. It sometimes presents considerable tubercular bosses, it is sometimes sprinkled with miliary tubercle, while in some cases a definite nuclear layer, apparently of a tubercular nature, may be traced in the submucous tissue.

It is to be noted sometimes that a distinct layer of false membrane will line the pelvic interior almost like that of diphtheria. (See woodcut at p. 793.) The connected ureter shares in the same changes; it becomes thickened, ulcerated, and transformed into, or occupied by, caseous material, often so as to lead to its complete and permanent closure, while the same result is in some cases attained by the protrusion into the channel of tuberculous nodules or bosses.



Section of the pelvic membrane of a tuberculous kidney, showing profuse nucleation underneath the epithelium.

Bladder. The bladder commonly participates, more especially near the entrance of the ureter which leads from the affected kidney, if there be but one involved, and in other parts, perhaps particularly, at least I have seen it so in several instances, about the exit of the urethra. The membrane often displays tubercular nodules and isolated or diffused ulcerations. The arrangement of such localisations in the line of the discharge is often suggestive of their dependence on its irritative or infective contact. It may indeed be inferred that tubercular disease of the ureter or bladder is commonly secondary to, and produced by, that of the kidney, from the circumstance that tubercular disease of the kidney is seldom associated with a similar condition of these cavities, unless the disorder in the glands have proceeded to ulceration and discharge. Among the cases I have referred to were thirty-four of excavation of the kidney, the tubercular character of which was testified to by tubercle in other organs. Among these, disease of the bladder or ureter was recorded in twenty-three instances, and would probably have been found even more often had the examinations been conducted with this question in view. Among thirty-eight instances of non-ulcerated renal tubercle these cavities were noted as diseased in but one example.

It is undoubtedly possible, though perhaps not very common, for the bladder to become tuberculous while the kidney is not so; but such is the tendency of tubercular suppuration of the kidney to produce disease of the same nature in the bladder, that the absence of vesical symptoms in presence of a purulent discharge from the kidney would indicate with little chance of error that the source of the pus is not tubercular.

Associated with tubercle in other organs.

The kidneys may participate in a general or scattered tuberculosis or may suffer alone. The former is by far the more common, insomuch that of ninety-five cases examined after death there were but eleven in which the disease was limited to one or both of these organs. Of all but one of these the subjects were adults.

It might be supposed that where the kidney only is affected the disease would reach in this organ a stage of further destructiveness than when it is liable to be cut short by similar changes elsewhere; but, however this may be, among the cases recorded were numerous instances of almost total destruction of the kidney by tubercular disease, in which other organs shared.

Among the ninety-five cases referred to there were forty-eight in which the disease had progressed to extensive excavation: in forty-one of these tubercles were found elsewhere than in the kidneys, in seven not. These facts lend little support to the views which have recently been imported, according to which caseation is in a considerable proportion of cases independent of tubercle. In the cases before us it was declared by the presence of widely scattered tuberculosis that the 'consumption of the kidney' was, in a large proportion of cases, associated with unmistakable tubercle.

Among eighty-four cases of tubercular disease of the kidney associated with tubercle in other organs (sixty-one from St. George's Hospital, twenty-three from the Hospital for Sick Children) were fifty-nine in which pulmonary tuberculosis existed, not including those in which the lungs took part in acute general tuberculosis. Among these were thirty-four instances of extensive pulmonary phthisis, eighteen in which the chronic tubercle was generally distributed, seven in which the lungs contained tubercular cicatrices or tubercle in small amount. Including the cases in which the lungs were involved as part of acute tuberculosis or tubercular meningitis, at least two-thirds of the number were the subjects of pulmonary tubercle—a fact of much diagnostic importance. Next to pulmonary tubercle in order of frequency came tubercular meningitis, which occurred in seventeen instances. It is worth remarking that of four of these the subjects were over twenty years of age, in three over forty years of age, so that in this, as in other associations, tubercular meningitis presents itself as by no means limited to childhood. In five of the instances of renal disease under discussion acute tuberculosis occurred without meningitis. Peritoneal tubercle or tubercle of the abdominal glands occurred in eight cases, tubercle of the supra-renal capsule in two, of the prostate in one, of the ovary in one.

Caries of bone was found in sixteen cases.

Roberts[1] observes on the comparative frequency of tubercular disease of certain of the male organs of reproduction, the prostate, vesiculæ seminales, and testicles, while with the female the generative organs have little tendency to be implicated. The clue to the local distribution of tubercular disease in cases of excavation of the kidney of this nature is to be found in the tendency of tubercular discharges to produce disease by their contact: thus the pelvis, ureter, bladder, and possibly the prostate and urethra, are apt to be involved. Nothing of the sort happens with cancer or other malignant disease of the kidney, which, however generally it may be disseminated, has no tendency to involve the outward passages. Apart from communication by discharge, organs other than the kidney become involved much according to their general proclivity, the lungs taking the lead.

Proportion of kidneys affected separately and together.

Both kidneys are affected together in about as many instances as one separately. If only one be affected it is more often the right than the left, though in childhood this difference is not apparent. Of ninety-five cases both kidneys were affected in forty-seven, one only in forty-eight. Taking childhood, apart from other periods of life, of twenty-eight cases of which the subjects were under twelve years of age, both kidneys were concerned in nineteen instances; one only in nine—the right in five, the left in four. Of sixty-seven cases in persons over twelve years of age, both kidneys were affected in twenty-eight; the disease was limited to the right in twenty-two, to the left in seventeen.

Frequency of renal tubercle in children and adults.

The accompanying table, compiled from the *post-mortem* books of St. George's Hospital and the Hospital for Sick Children, shows the frequency of renal tubercle in childhood and afterwards in persons dead from all causes. Considering how rarely consequences attributable to renal tubercle are detected during life, it might not have been anticipated that this formation is to be found on an average in about a tenth of all who die—in children in nearly a sixth.

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[1] *Roberts*, 2nd edit. p. 547.

Tubercle is especially a disease of early life, as the table shows; but the proclivity of the disease in this respect is more strongly displayed in regard to the brain, the abdominal structures, and the kidneys than with regard to the lungs. Renal tubercle is nearly three times more frequent under than over the age of twelve.

Table showing the frequency of tubercular formations in the kidney, and other organs, in 600 *post-mortem examinations; the subjects of* 300 *being under the age of* 12 *years, the subjects of the other* 300 *being of the age of* 12 *years and upwards.*

	In 300 *post-mortem* examinations of children under 12. (Hospital for Sick Children.)	In 300 *post mortem* examinations of persons of 12 years old and upwards. (St. George's Hospital.)	The total of 600 *post-mortem* examinations of persons of all ages
Tubercle present in some part of the body, in	126	54	180
Tubercle in lungs, in	104	51	155
Tubercle in peritoneum or mesenteric glands, or tubercular disease of bowel, in	97	22	119
Tubercle in brain or its membranes, in	63	9	72
Tubercle in kidney, in . . .	49	17	66

Clinical History and Symptoms.

Distribution as to age and sex.

Tubercular disease of the kidney during childhood affects the sexes with impartiality; in later life it attacks the male more often than the female. Of twenty-eight hospital cases which occurred under the age of twelve, fourteen affected male, and fourteen female subjects. Of sixty-seven cases over this age, forty-four related to males, twenty-three to females—a proportion of nearly two to one.

So far as we may trust the experience of a general hospital, at which cases of every kind and of all ages are admitted, tubercular disease of the kidney is most frequent between twenty and forty, rare after fifty. That it is common at all the epochs of childhood the records of the Hospital for Sick Children abundantly show. It occurs in early life as part of acute tuberculosis and in association with tubercular meningitis, and therefore presents itself with frequency under the age of four, when these conditions are most common. In such circumstances, and indeed more often than not at every time of life, renal tuberculosis occurs merely as a small part of a scattered disease, with the incidence of which its distribution corresponds; while it may be added, that in such circumstances its presence is seldom declared by any symptoms which are recognised as renal.

Age at Death with Tubercular Disease of the Kidney.

ST. GEORGE'S HOSPITAL—70 CASES.

Age in years	Number fatal at stated age
1 to 10	4
11 „ 20	13
21 „ 30	18
31 „ 40	20
41 „ 50	11
51 „ 60	1
61 „ 70	2
71 „ 80	1

HOSPITAL FOR SICK CHILDREN—24 CASES.

Age in years	Number fatal at stated age
Under 2 years old	3
2 years old and under 3	4
3 „ „ „ 4	3
4 „ „ „ 5	3
5 „ „ „ 6	1
6 „ „ „ 7	3
7 „ „ „ 8	0
8 „ „ „ 9	3
9 „ „ „ 10	3
10 „ „ „ 11	0
11 „ „ „ 12	1

Exciting causes.

The most frequent causes of renal tubercle are those of tuberculosis in general, among which inherited proclivity takes the first place. Caries of bone, as with tubercle in general, is often noted as an antecedent. Measles, so often to be recognised as incentive of tuberculosis, is occasionally followed by tubercle thus localised. This occurred in two of the cases I have referred to from the Hospital for Sick Children. Lastly, as giving rise to the disease primarily and chiefly localised in the kidney, blows and falls upon the lumbar region are conspicuous. Among the cases to which I have referred were three in which the injury was so directly followed by the symptoms of the disease that there could be no hesitation in regarding them as cause and effect. A man was knocked down by a cart and injured in the right lumbar region. This remained persistently painful. Four years afterwards the right kidney was found to be extensively excavated, and the pelvis and ureter thickened; the lungs contained scattered tubercle but no vomicæ. A man had a fall upon his back, which was followed by symptoms of psoas abscess, with which he died three years afterwards. The psoas abscess was found to be connected, as was expected, with disease of the spine; but, in addition, both kidneys were stuffed with softening tubercle, and the pelvis, left ureter, and bladder ulcerated. In the last case a man hurt his back, and for some time afterwards passed bloody urine. He died in three months, after an epileptiform attack, apparently uræmic. Both kidneys were full of tubercle, miliary in the right, caseous and suppurating in the left. Miliary tubercule was also found in the lungs. Cold has been assigned as a cause of renal tuberculosis, but my cases give no instance of this association.

Blows and falls.

Symptoms.

The symptoms are those of suppurative pyelitis, usually with an elevated night temperature and vesical irritation. The constitutional signs of tuberculosis, chronic fever and wasting, are commonly present, while the subject is often of scrofulous appearance or antecedents.

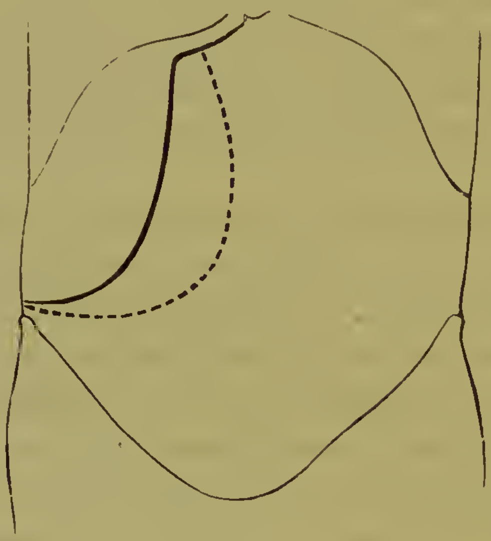
There is sometimes pain in the loins and occasionally down the ureter, though less sharp in either situation than may be produced by stone. The bladder-symptoms are possibly so urgent as to raise a suspicion of calculus: there may be much discomfort referred to the position of the bladder or to the penis, while micturition is frequent, even hourly, and sometimes difficult; there is, however, this distinction from stone—when the bladder is empty relief is complete. The patient is usually sounded, and only a little roughening detected. Another distinction from stone is to be found in the continuance of the purulent discharge with the urine; when from stone the discharge is apt to stop, often for months, and then recur; if from tubercle, the first complete stoppage is final, as it is due to the occlusion of the ureter from extension of the disease, or to the consumption of the tubercular growth. Local

The constitutional symptoms are more tuberculous than renal, unless, as is no infrequent complication, lardaceous disease be superadded. Among ninety-five hospital cases to which I have before referred, in some of which it must be allowed that the disease had not advanced so far in the kidney as elsewhere, convulsions or coma were recorded as the direct result of renal tuberculosis only in three instances; less often than in this series of renal cases similar symptoms occurred as the result of the participation of the brain in the disease, in the shape of tubercular meningitis. and general.

It is strange that uncomplicated tuberculosis should so seldom cause either uræmia or suppression, considering how frequently both kidneys are involved in the disease. The symptoms are mostly those of exhaustion, as a result of the discharge, together possibly with the effects of the advance of tubercular disease in some other organ. The patient undergoes slow wasting, much as if the consumption were of the lung instead of the kidney—too often it is of both, as the foregoing statements show—has evening fever and night-sweats, and often lapses into fatal prostration, with a dry tongue and a typhoid aspect. An important point in the diagnosis of renal as of other tubercle is the temperature. In the case referred to on page 810, the morning and evening records were generally 98° and 102°, frequently 97° and 103°, giving a nightly rise of from 4° to 6°. In many other instances the temperature was that proper to general or pulmonary tuberculosis.

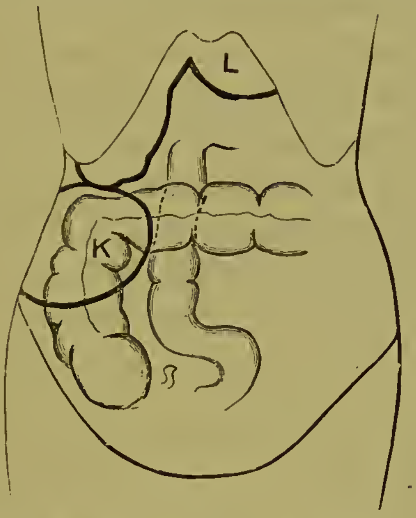
Tumour.

It is comparatively rare for tubercular disease of the kidney to produce palpable tumour, but I have met with two instances in which this occurred, and to a sufficiently noticeable extent. In both, the right kidney was the one to which the tumour belonged, and the hypochondrium the place in which it became evident. The outlines of the swelling in each case are represented in the annexed woodcuts; its renal character in each was clearly declared during life. In one case, that of a woman named Ann Evans, sixty-one years of age, the tumour was felt extending from the edge of the ribs to the level of the umbilicus: the inner part was overlaid by bowel, the outer was immediately beneath the abdominal wall; the mass could be felt deep in the lumbar depression. After death the right



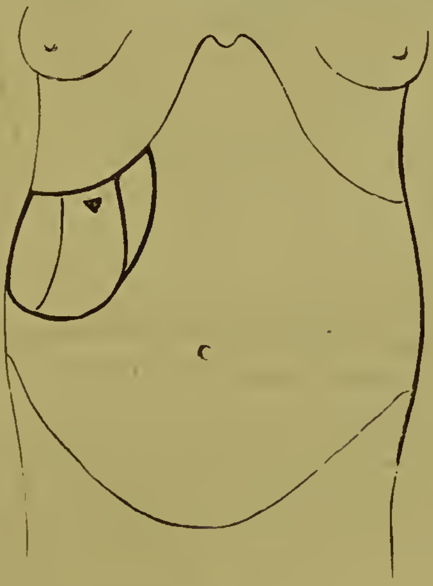
Tuberculous kidney (from case of Ann Evans), as felt during life; between the outer and the dotted line the tumour was overlaid by bowel. (See page 798.)

kidney was found to be enlarged by tubercular disease, but appeared less prominent than it had done during life.



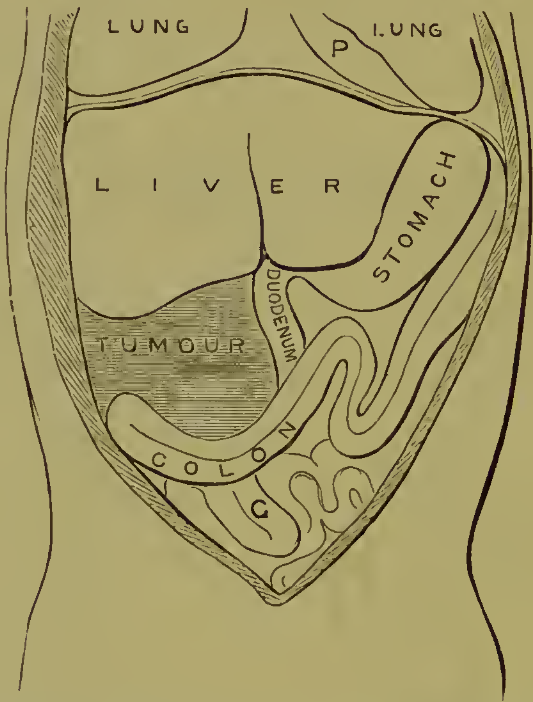
Tuberculous kidney (from case of Ann Evans), as exposed after death, showing its relation to colon and duodenum. K, Diseased kidney; L, Liver.

It had the ascending colon immediately in front; the duodenum was closely adherent to its inner edge, where



Tuberculous kidney, which had been tapped in the belief that the tumour was hepatic. As felt during life. The place of the puncture is indicated. The tumour was superficial outside the faint vertical line, very deep inside the stronger vertical line.

was a tubercular abscess, the outer wall of which consisted of this portion of the bowel. In the second instance, the morbid features were almost the same. A mass lay in the right hypochondrium, reaching from the edge of the thorax to three inches downwards in the nipple line. The mass, which was on its inner part covered by bowel, could be traced under the abdominal wall, round the side, to the lumbar region. The patient came into the hospital as having an abscess of the liver, and a depressed cicatrix was pointed out as the place of its puncture some five years before. But though in contact with the liver, the mass was unequivocally renal. There was no depression of the liver edge, or indication of increase of size in this organ, while, on the other hand, the mass could be traced into the lumbar region and grasped in this situation between the hands. *Post mortem*, the right kidney was exposed to view below the liver as soon as the integuments were put aside—across the lower part lay the beginning of the colon. The duodenum, as in the preceding case, was in contact with its inner edge. The kidney, little changed in shape, though much in size, measured six inches in



Tuberculous kidney, as shown after death (from same case as preceding). The upper part of the tumour was uncovered by bowel.

length, extending from the last dorsal to the last lumbar vertebra.

Resultant lardaceous disease.

When the kidney excavates, and the process is not cut short by disease elsewhere, the symptoms are so often complicated with those of lardaceous disease, that these may be regarded as almost necessary to the later stages of the complaint. The urine becomes pale, it displays more albumen than the pus could account for, the legs become dropsical, and the patient sinks, with vomiting and diarrhœa, or, as I have seen in more than one instance, dies with the ordinary signs of cerebral uræmia.

Irregular exits of matter.

Among the accidents which occur in the course of the disease are irregular modes of exit for the matter developed within the kidney: when this is of tuberculous origin it far less often escapes otherwise than by the ureter than when dependent on stone, but it does so sometimes. Among the cases from St. George's Hospital to which I have referred, is one in which the front of a tuberculous right kidney presented a sloughy aperture which communicated with a large abscess, which lay behind the peritoneum in the lumbar region, between the kidney and the ascending colon and the duodenum. In another instance, a hole similarly formed in the left kidney had given rise to an abscess circumscribed by adhesions within the peritoneal cavity. A third case was a somewhat remarkable example of a psoas abscess of renal origin. A young man had a psoas abscess which discharged in the usual situation for a year, and of which he died without any suspicion that the abscess was not spinal. It proved to have its source in the left kidney, which was extensively excavated by tuberculous disease; but, strange to say, there was also found, though upon the other side, an incipient psoas abscess, connected, as is usual, with diseased vertebræ. This had penetrated about two inches into the muscle.

Urine.

The urine usually shows traces of albumen even before the tubercle has proceeded to softening. I have before me records of the state of the urine in six cases in which the kidneys were found after death to contain unsoftened tubercle: in four albumen was detected; in one a little blood as well. There are as yet no other changes, but as soon as the organ begins to excavate, pus appears, though it is seldom so 'laudable,' not so sharp in microscopic outline, nor separating so cleanly from the supernatant urine as when pyelitis is the result of stone. Blood is observable in a minority of cases, it is seldom in large amount. In the course of thirty-nine cases from St. George's and the Hospital for Sick Children in which the state of the urine is recorded, hæmaturia was noticed in nine. In three of these it was connected with much disease of the bladder, and presumably of vesical origin. In one it was associated with marked lardaceous disease. In the remaining cases the discharge of blood was apparently dependent on the tuberculous condition of the kidney or its outlet. In no instance was the discharge profuse, though it was in some obstinate, especially where connected with vesical disease. As the disease progresses, the urine is apt to become ammoniacal and variously putrid and offensive, to be mingled with ropy mucus, and to deposit triple phosphate, often as the results of vesical disease; bnt it may be alkaline and even ammoniacal in consequence of disease limited to the kidneys. Both may be so much damaged that only pale alkaline urine of low specific gravity is secreted, and this may become more or less decomposed by partial retention in the pelvis, and thus be passed ammoniacal, as in a case recently under my care, even though there be no such bladder-disease as to account for the alteration within this cavity. Often with the advance of the disorder the urine becomes highly albuminous, and displays hyaline casts as the consequence of the superaddition of lardaceous change, by which the secretion of the hitherto unaffected kidney becomes modified. The occasional impoverishment of the urine, with a specific gravity as low perhaps as 1006, is occasionally a marked result of double tuberculous disease of the kidney, even though there be no lardaceous change, or this be only incipient and trifling.

Duration of disease.

The time that elapses between the commencement and the close of renal tuberculosis is difficult to limit; many cases are cut short by pulmonary phthisis, and many by meningitis: taking those in which the beginning has been marked and the end mainly renal, it would seem that the range extends from about four months to as many years.

In those instances in which the outset was marked, and apparently occasioned by a blow or fall, the duration of the disease was respectively four months, three years, and four years. A renal psoas abscess was open for a year before death; an abscess of the same origin in another case which discharged from the thigh was open also for a year; the organic disease necessarily of longer date. In three instances in which the presence of the disease was declared only by the more ordinary symptoms, these were noted for periods before death of seven weeks, eight months, and four years respectively. In the case with the briefest record, however, one kidney was reduced to a mere shell, so that the disorder had existed for a much longer time than the symptoms appear to have been observed.

Prospect of recovery.

Instances are met with in which one kidney has been destroyed by suppuration apparently tubercular, and the disease has been limited, has become quiescent and practically harmless. Some of these cases, however, are of doubtful nature; the absence of tubercle elsewhere, which is almost necessary to recovery, may raise a doubt as to whether the suppuration may not have been of other than tubercular origin. It is sufficiently obvious that destruction of a kidney by calculous pyelitis or some other form of suppuration is a less dangerous process than when a disseminating growth is the agent; but there is no reason to doubt that tubercular disease of the kidney, as of the lung, may sometimes be restricted and be outlived, though the frequency with which other organs participate, as shown at page 801, is a discouraging fact in its natural history.

Treatment: Medical;

The treatment of renal tuberculosis involves, first, that of the constitutional condition, and may be much that called for if the consumption were pulmonary instead of renal — nourishing diet, sea-air, iron, quinine, and the general anti-tuberculous regimen. The tendency of the urine to alkalinity, and, when alkaline, to putrescence, with possible results in the way of septic absorption, may be met by the use of the mineral acids, quinine and perchloride of iron. I have sometimes found distinct advantage, when the urine has been offensive, from the use of creasote by the mouth, though I think that such antiseptic treatment is not so often called for as when urine is locked up in the pelvis in consequence of stone. The bladder-symptoms, which are often pressing, and may be regarded as generally necessary to the disease, may be palliated by pareira, with hyoscyamus or belladonna and opium, or by these sedatives as suppositories.

Surgical.

It is scarcely necessary to dwell upon the surgical considerations. I have known a distended and tuberculous kidney to be punctured with the aspirator with relief.

Excision of kidney.

With regard to the excision, it must be presumed that so dangerous an operation would not be justifiable, were not permanent cure likely to ensue upon its immediate success. It has been shown (p. 803) that both kidneys are affected by tubercular disease about as often as one alone; and further, that, given advanced renal disease of this nature, there is only about one case in seven in which the formation is not shared by other organs. These facts would appear enough to discourage, and probably to prohibit, the operation. It was performed fatally by Peters, in a case referred to in the table in Chapter XIV. Lucas[1] removed a supposed tuberculous kidney with success, but as the organ was described only as containing abscess-cavities, there must remain doubt as to the nature of the disease. Baker[1] removed with present success, from a child of seven, a kidney which proved to be tuberculous: six months afterwards the urine still contained pus. Dr. Goodhart[2] and Mr. Golding Bird record the unsuccessful excision of a scrofulous kidney from a man of the age of twenty-seven, who had a temperature which ranged from 100 to 104. The operation proved tedious and difficult, and the patient died four hours afterwards. The tubercular disease proved to be confined to the kidney, which had been removed, excepting that it involved the ureter and to a slight extent the bladder. Dr. Cole[3] of Bath has recorded an interesting instance in which a tubercular kidney would have been extirpated, had not the patient begun to die on the day before that fixed for the operation. It was found that the kidney not in question had been so completely destroyed by antecedent disease of the same nature, that the removal of the organ to which the symptoms referred would have taken away all that remained of the secreting tissue.

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[1] *Trans. International Med. Congress*, vol. ii. p. 271.

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[1] *Trans. International Med. Congress*, 1881, vol. ii. p 262.

[2] *Clinical Transactions*, vol. xv. p. 129.

[3] *Brit. Med. Journ.* Aug. 5, 1882.

CHAPTER IX.

HYDRONEPHROSIS AND PYONEPHROSIS.

Definition and general description.

WHEN the cavity of the kidney is extended by aqueous fluid, the condition is described as hydronephrosis; when by purulent fluid, as pyonephrosis. Hydronephrosis, *hydrops renum*, or dropsy of the kidney, is a condition to which much practical interest attaches, since it is apt to present itself as an abdominal cyst of which the nature may be mistaken, and with regard to which questions of operation may present themselves, whether it be recognised as renal, or regarded as ovarian, or as ascites. Hydronephrosis may be congenital or acquired, of either kidney or of both, constant, variable, or intermittent.

It is difficult to draw a line which shall always hold good between hydronephrosis and dilatation, for hydronephrosis is only extreme dilatation. For the most part hydronephrosis affects one kidney only, and arises in obstruction of the ureter; the accumulation is now cut off more or less completely from the vesical cavity, is not relieved by the emptying of it, and consists not so much of urine as of an aqueous fluid which bears only a remote resemblance to it. The distension is here persistent as well as extreme, and the distinctions between this condition and the more passing kinds of dilatation are sufficiently marked. They hold good no less when both kidneys are affected, as they sometimes are, from similar or accidentally concurrent stoppages of both ureters. But the name is also applied to extreme dilatation of the urinary cavities from obstructions in the urethra or bladder, in which the distending fluid is urine, not at all or but little altered; in such circumstances it may be a somewhat arbitrary matter to decide whether hydronephrosis or dilatation shall be the term employed.

Sources of information.

The following account of hydro- and pyonephrosis is based in part upon an analysis of sixty-nine cases completed by *post-mortem* examination, which I have brought together from various publications, the descriptions of preparations which I have had opportunities of examining in several museums, and my own practice. I may say that twenty-two of the whole number are derived from the records of St. George's and the Hospital for Sick Children, and are for the most part unpublished. In collating published cases I have been greatly indebted to the paper of Mr. Henry Morris, in the fifty-ninth volume of the 'Medico-Chirurgical Transactions.' My records contain forty-three cases of single, sixteen of double, hydronephrosis, and ten of pyonephrosis. This may represent the relative frequency of these conditions. It is not practicable to separate the consideration of pyonephrosis from that of hydronephrosis, since the two conditions are usually but different phases of the same disease.

Subjects, sex, and age.

Hydronephrosis is distributed between the sexes, like most renal diseases, with a slight preponderance towards the male side. Of sixty-one cases of hydro- and pyonephrosis, certified by *post-mortem* examination, of which I have records to the point, thirty-two belonged to the male and twenty-nine to the female sex.

This is of interest in relation to the origin of the renal in uterine disease, which would seem not frequent enough, in comparison with other causes, to give preponderance to the female sex.

With regard to age, none is exempt. Of 51 of the above-mentioned cases, in which the age is stated, death occurred at birth, or within a few hours of it, in 3; during the first year of life in 5; between the ages of 1 and 10 in 10; between 11 and 20 in 5; between 21 and 30 in 6; between 31 and 40 in 8; between 41 and 50 in 9; between 51 and 60 in 2; between 61 and 70 in 1;

between 71 and 80 in 2. Thus death from this cause is especially frequent during the first ten years of life, as the result of congenital lesions; as an acquired disease, largely due to stone, it produces its fatal issue with increasing frequency up to 50, beyond which age it is seldom delayed.

Side affected.

Of the cases in which hydro- or pyonephrosis affected one kidney only, the side is stated in 45: 25 left, 20 right. It is probable that this difference is accidental: I do not find that stone, apart from hydronephrosis, exhibits any decided preference for one side.

Causes of hydro- and pyonephrosis.

For the causes of hydro- and pyonephrosis I might refer to the chapter on Diseases of the Ureter as comprising their greater number; but as all could not be here included it is needful to take them into separate consideration. For the production of the great dilatation to which these names are given it is generally needful that the exit of the expanding cavity or cavities should be obstructed, but not completely and finally. Cases are known to occur, like one recorded by Rayer (vol. iii. p. 488), in which the ureter was from the first impervious and incomplete, but as a rule such absolute and permanent stoppages are attended with atrophy of the kidney, its extensive dilatation commonly being due to an obstruction which is either incomplete or intermitting.

It is certain that a larger number of cases of hydro- and pyonephrosis are due to stone than to any other cause; as compared with this all other causes are, separately, of slight frequency, though they appear numerous when taken together. Many of the causes which have been assigned to the disease—obliquities, twists, and valvular openings of the ureter, may, with as much probability, be placed among its consequences.

In the collection of cases to which I have referred, comprising sixty-nine *post-mortem* examinations of hydro- and pyonephrosis, the causes of the dilatation, or in other words the nature of the obstruction, is thus stated:—

Causes of Single Hydro- and Pyonephrosis	Hydro-nephrosis 43 cases	Pyo-nephrosis 10 cases	Total of both 53 cases
Calculus in affected kidney or ureter	11	6	17
Calculus in unaffected kidney, cause of obstruction not further ascertained, presumably a stricture left by a stone	2	—	2
Villous growth from pelvis of kidney	1	—	1
Congenital imperviousness of ureter	1	—	1
Compression of ureter by swollen lymphatic gland	1	—	1
,, ,, cancer of pancreas	1	—	1
,, ,, band of peritoneal adhesion	1	—	1
,, ,, abnormal branch of renal artery	1	—	1
Stricture of ureter the result of a kick	—	1	1
Ureter degenerated into solid cord	—	1	1
,, of small calibre	1	—	1
Sudden bend in ureter	1	—	1
Valvular structure or arrangement, or obliquity of position, in connection with renal origin of ureter	5	—	5
Valvular structure in connection with vesical exit of ureter	1	—	1
Stricture of ureter of unexplained nature	6	—	6
Villous tumour of bladder affecting orifices of ureters	1	—	1
Cause not satisfactorily ascertained	9	2	11
	43	10	53

Causes of Double Hydronephrosis—16 *cases.*

Calculi in both kidneys	1
Calculus in one kidney or ureter, stricture in other ureter, possibly of calculous origin	2
Corkscrew twist in both ureters	1
Abnormal arrangement of renal artery compressing one ureter, congenital narrowing of the other	1
Stone in bladder	2
Stricture at neck of bladder	1
Congenital stricture or imperfection of urethra	2
Stricture of urethra, not congenital	1
Congenital obstruction apparently in urethra, but not clearly ascertained	3
Diabetes insipidus	1
Cause not ascertained	1
	16

It is at once seen that the causes of the single and of the double affections are for the most part different. The dilatation when one-sided is invariably due to obstruction of the ureter or its orifices; when bilateral it is in some cases due to simultaneous obstruction of both ureters, but more often to hindrance in the exits common to both kidneys, the bladder and urethra.

Of unilateral dilatation.

Taking one-sided dilatation first, it is seen that of 42 cases in which the nature of the obstruction was ascertained this was clearly due in 17 cases to stone in the kidney or ureter, while in 2 others calculus in the unaffected kidney suggested the probability that there had once been a stoppage of the same nature on the side which was the seat of the obstruction. A small stone may lodge for a time in the ureter, and then pass out, leaving an abrasion, which will eventuate in a cicatrix and a stricture. It is possible that some of the cases in which only an unexplained stricture of the ureter has been found may have had such an origin. Causes of compression of the ureter external to itself, tumours, enlarged glands, and bands of adhesion find place, but it is to be noted that disease of the uterine organs is not frequent in this relation.

Stone.

Other causes.

Cancer of the uterus is apt to involve both ureters rather than one only, and then appears seldom to cause the larger degrees of dilatation which are now under discussion. Suppression of urine would seem to be a more common result of such lesions than hydronephrosis. The traversing of the upper part of the ureter by an abnormal branch of the renal artery is generally accepted as a cause, however infrequent, of its obstruction. It might have been supposed that the relaxation of the artery during diastole would have afforded sufficient exit.

Obliquities of ureter.

Another class of causes is still more problematical. A comparatively large number of cases are attributed to obliquities, sudden bends, and valvular arrangements of the ureter at its origin. It is obvious that if the pelvis be dilated more on one side of the origin of the ureter than the other (and such irregularity often happens) the origin of that tube may be subjected to lateral compression or made to slant, so that the membrane on one side may overhang and perhaps occlude the orifice; but it may be suggested that in many or most of these cases the distortion of the orifice is in the first place the result of dilatation of the pelvis, though it may be a means of increasing it. Great extension of the pelvis must necessarily change the position and relations of its duct.

In the case, for example, of congenital hydronephrosis reported by Mr. Glass ('Phil. Trans.' 1746), where the cyst held thirty gallons, the ureter, which was not otherwise obstructed, was abruptly bent and opened obliquely into it. It is clear that much displacement of the ureter was inevitable as a result of the distension; we are left in doubt as to its original cause, save that it was not a permanent and complete organic stricture. One case is referred to from St. George's Hospital, in which the obstruction, which was of intra-uterine origin, was a loose fold of mucous membrane in the ureter within the vesical wall; this presents itself as a first cause with more probability than the valvular arrangements which are so often found at the junction of the ureter and the distended pelvis.

Valvular arrangements of ureter, &c.

Much dilatation has been known, as in a case reported by Mr. Morris,[1] to follow upon vesical growths involving the orifices of one or both ureters. In Mr. Morris's case there were growths in connection with both orifices; one kidney was dilated, the other atrophied. Lastly, injuries of the ureter by violence from without—in one case by a kick from a horse,[2] in another by a fall at leap-frog [3]—were followed by obstruction and accumulation, whether of aqueous or purulent matter.

Causes of double hydronephrosis.

Double hydronephrosis depended upon obstructions in or about the bladder or urethra in a proportion of nine instances out of fifteen, in which the seat of the difficulty was approximately ascertained. In the majority of these cases the obstruction was congenital and involved the urethra. An instance has been recorded in which the obstruction was apparently a membranous obstruction at the vesical end of the urethra. This was broken down with a sound, after which urine was passed freely, and the swelling disappeared. The child, three days old at the time of the operation, had passed no urine since birth.[1]

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[1] *Med.-Chir. Trans.* vol. lix. p. 232.

[2] See chapter on Diseases of the Ureter.

[3] See case quoted at p. 838.

A peculiar obstruction has been described by Dr. Hare as the cause of double hydronephrosis, which, like many of the lateral and valvular orifices so common with the unilateral condition, may not improbably be its result. Each ureter was coiled, at a little distance from its origin, 'like a turn and a-half of a corkscrew brought closely together,' the coils being adherent to the dilated pelvis, and held together by the tissues around, upon the detachment of which by dissection the channel gave ready exit to the accumulation above, which before could not pass, even when the kidney was subjected to pressure. It is to be suggested that the coiled condition may have resulted from some process in the course of disease, whereby the extremities of each ureter have been unnaturally approximated; each duct would thus have a superfluity of length which must be disposed of in curves or coils, or otherwise than as a straight line. Hypothetically, the ureters might be rendered longer than their course by depression of their orifices, such as might arise from enlargement of the pelves, by elevation of their exits from distension or displacement of the bladder, or by elongation of the ureters themselves as the consequence of dilatation. The conditions, whatever they were, which preceded the twists were in the end obscured by their results; these circumvolutions, like the bends and valvular entrances so often described, though probably not the originators of the distension, were at least causes of its increase. One case of double hydronephrosis is ascribed to pressure upon one ureter by an abnormal branch of the renal artery, while the duct on the other side was congenitally narrowed. Diabetes insipidus, by means probably of the profuse secretion of urine which it entails, causes extreme dilatation of both kidneys, which may be called hydronephrosis, if dilatation due to urethral or vesical obstruction be so termed.

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[1] Lamotte, quoted by Morris, *Med.-Chir. Trans.* vol. lix.

When hydronephrosis arises before birth, the swelling may be enough to cause difficult labour. The child may be stillborn or perish in early infancy, or the cause may, particularly if one kidney only be affected, operate gradually and declare itself only in advanced life.

Uterine disease.

Disease of the uterus or ovaries is a frequent cause of the lesser degrees of hydronephrosis, which are usually described as dilatation. Dr. Roberts, in collating the causes of fifty-two cases of hydronephrosis, assigns six to encroachment upon the ureters of disease of the uterus, ovaries, or pelvic organs. Cancer of the uterus, starting equidistant from both ureters, is apt to involve both, if either, and seldom gives rise to enough swelling to cause a tumour palpable during life. Mr. Morris observes that at the Middlesex Hospital, where the cancer wards supply a large number of cases of cancer of the pelvic organs, and where scarcely a week passes without the presentation in the dead-house of some degree of hydronephrosis from this cause, yet that none of the present surgeons remember to have detected an abdominal swelling of this nature during life. The comparative rapidity of malignant disease, and the fact that both sides are so often involved, does not give the opportunity for extreme expansion which is found with more chronic conditions, and where one kidney is left to perform the function of both. Displacements, also, of the uterus may cause obstruction of the ureters and accumulation in the kidneys, though perhaps not enough to give rise to tumours tangible clinically. Retroflexion of the uterus has been shown to bend and so obstruct the ureters as they pass by its side, and prolapse to displace the bladder and compress the uretral exits.

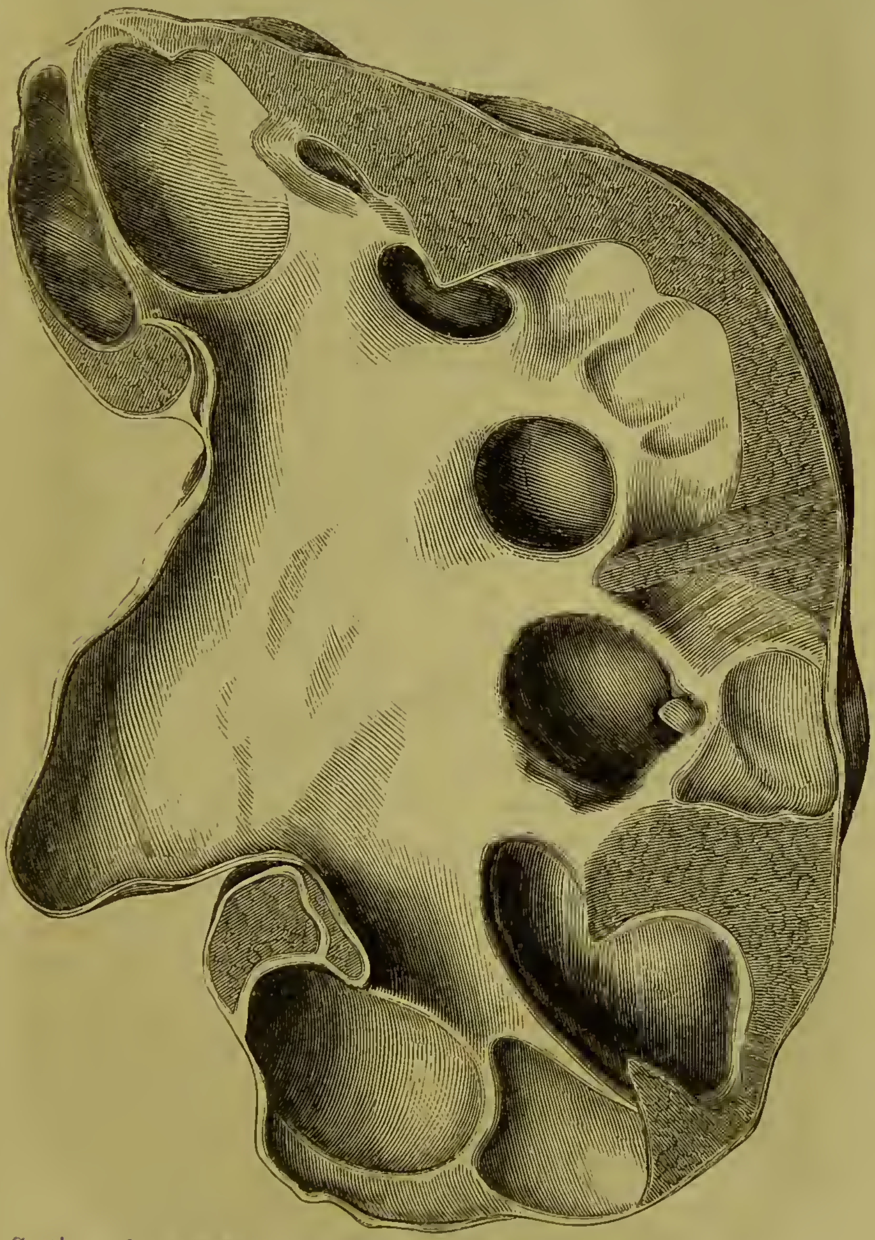
The obstruction which gives rise to hydronephrosis is, as already stated, usually incomplete. Instances are known in which the pelvis of the kidney has been without exit from the first, and the child born with hydronephrotic distension, as in a case quoted by Rayer, from Billard;

but more often in such circumstances the kidney is simply atrophied. Occasionally in older subjects great dilatation has been found to be due to a stone, which after death at least appears completely to block the infundibulum; but such obstacles have necessarily been of slow formation and the stoppage long imperfect. As regards the course of the ureter, a perhaps narrow, but not impervious, stricture in connection with stone is a more common cause of hydronephrosis than the impassable lodgment of stone itself. The rule is, that if the adult kidney become suddenly and completely occluded, the consequent dilatation is not excessive. When the ureter is stopped two processes ensue—dilatation and atrophy; when the stoppage is incomplete the former predominates, when complete the latter. The urine is secreted with so little force that the point of accumulation is soon reached which puts an end to it. The gland will now secrete only as much as is removed by absorption and leakage. The absorption is insignificant; if there be no leakage the secretion will be virtually at an end, and the organ become effete from disuse; if there be leakage the secretion will go on *pari passu*, the activity of the gland be maintained, and with it a slight but constant pressure upon the cavity. Reviewing the causes of hydronephrosis—meaning by this dilatation enough to be palpable during life—it is clear that the majority involve only partial or intermitting stoppage: stricture rather than obliteration, injuries caused by stones more often than their impassable fixture, valvular entrances and exits, obliquities, twists, and external pressure, whether by arteries or growths.

Obstruction to cause hydronephrosis usually incomplete.

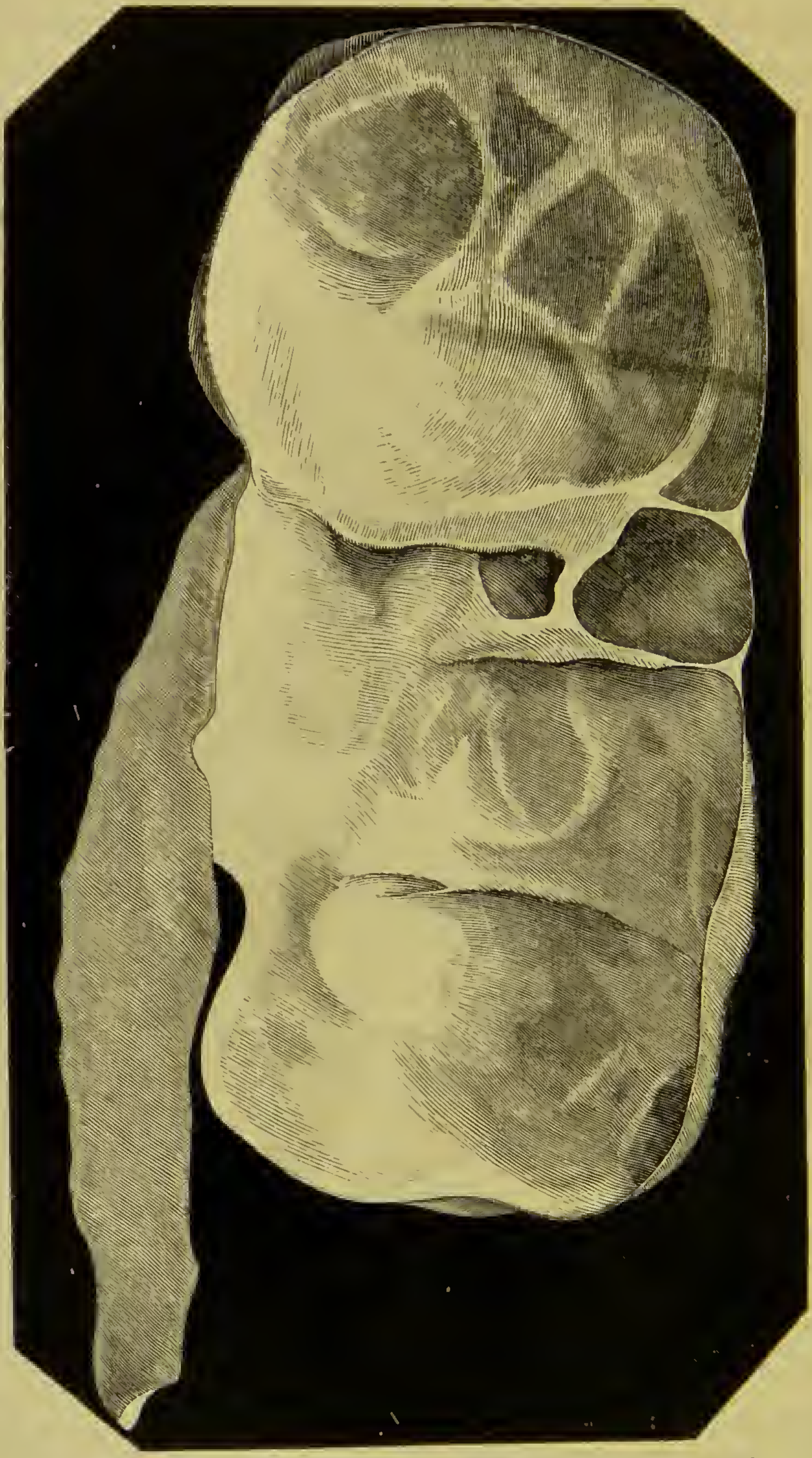
Pathological changes with hydronephrosis.

Given the required obstruction—necessarily incomplete, should both sides be involved, as death by suppression would prevent any chronic changes—and a sufficiency of secreting tissue, distension, and dilatation of the pelvis may ensue which, according to its contents, is hydro- or pyonephrosis. Pyonephrosis is hydronephrosis *plus* pyelitis. The mammillary processes are replaced by depressions, and the cones by excavations, which increase until they are separated from each other only by plates of condensed fibrous tissue, while the contact of the pelvic membrane with the capsule is prevented possibly only by remnants of renal tissue, scarcely recognisable except with the



Section of a kidney dilated in consequence of the impaction of calculi. The expansion of the infundibulum and calyces, the latter of which open like diverticula into the pelvis, is well shown. The calculi, which were of uric acid, have not been preserved. (From a preparation at the London Hospital.)

microscope. As the swelling increases it loses more and more of its renal character, retaining, however, in most



A kidney which has become converted into a delicate translucent cyst, nothing apparently remaining but the capsule, the pelvic lining, and some septa, which indicate the original structure of the organ. The ureter hangs down similarly stretched and attenuated. The kidney is but little enlarged externally, however extended within. There is no record of the nature of the obstruction—it may have been stone. (From a preparation at the Middlesex Hospital.)

cases something of the renal outline, and still having abbreviated partitions, or radial folds on its inner surface.

The organ in extreme cases will expand into a thin ovoid cyst which, as far as regards the outside, is to be recognised as renal only by its relations to the ureter and the colon, which latter is usually inseparable from its surface. If the inside of such a cyst be examined, it is possible that all septa may have disappeared, but a record of the renal structure be still preserved in a peculiar delineation, for it may be little more, which marks the places where the mammillary processes pierced the pelvic membrane. The lining of the cyst may present an arrangement of round holes which look as if they had been punched, through which protrude thin laminæ, which are the attenuated and extended cones. The effect is that of a 'slashed doublet,' the lining showing through the cuts. The dimensions of such a cyst may be great, or even gigantic. In a boy of eight at the Hospital for Sick Children, the longer and shorter diameter of an ovoid cyst of this nature were nine and eight inches, and its contents eighty-three ounces. This, though large for so small a subject, is enormously exceeded in the adult. I have elsewhere (p. 743) referred to a largely dilated kidney, which had given lodgment to an accumulation of colloid material; the kidney, which still retained its shape, measured eleven inches by six, and far larger examples could be cited, the only limit being the capacity of the trunk. The largest instance on record is probably one which I have already referred to, and which has been quoted by Dr. Roberts, from the report of Mr. Glass in the 'Philosophical Transactions' for 1747. A woman, who had been dropsical from birth, died at the age of twenty-two; her belly then had a circumference of six feet four inches, and measured four feet and half-an-inch from the ensiform cartilage to the pubes. The swelling was produced by a cyst, which represented the right kidney, and held thirty gallons all but a pint of liquid, limpid as urine, but lightly tinged of a coffee colour. The ureter opened into this cyst without recognised obstruction.

Dilatations of ureter and extra-renal cysts simulating hydronephrosis.

The distension of hydronephrosis is usually general to the pelvis, but instances occur in which it is limited to a portion of its wall, and others in which a cyst from the outside has become connected with the renal cavity. As an instance of partial or local dilatation there is a preparation at St. George's Hospital, which exhibits a great expansion, limited to the top of the ureter and its funnel-shaped entrance, the pelvis itself being elsewhere but little affected. This superadded cavity, which may have held half-a-pint, stretches inwards from the kidney, and must have extended during life across the vertebral column.

Contents of hydronephrosis.

The contents of the cavities which have been described are watery or purulent, as their names imply. Within the term hydronephrosis there is a considerable variety. If the dilatation, as often in double hydronephrosis, be common to all the urinary cavities, their contents will be urine, little changed, save that the specific gravity may be low, as with urine secreted against pressure, and it may have become ammoniacal. In Dr. Little's case, where both kidneys were distended from a congenital obstruction below the bladder, the fluid withdrawn by tapping had an urinous smell, and contained urea and uric acid, but had a specific gravity of only 1004. It is sufficiently obvious that when hydronephrosis depends upon stoppage below the bladder, as in most cases of congenital origin, the collected fluid is necessarily urinous, since it contains the whole renal secretion. When the dilatation is of one kidney only, the destruction or metamorphosis of the organ may be carried further than is consistent with life where both are involved; but even in the most extreme of these cases, if the cyst be actually a dilatation of the kidney, the fluid gives evidence of urinary constituents, unless much changed by decomposition, or replaced by suppuration or colloid. The fluid found in unilateral dilatation is usually clear, either aqueous or albuminous, urinous in appearance and smell, and giving evidence of urea and uric acid to chemical tests. It has sometimes been dark in colour, probably from blood; the liquid in Mr. Glass's case was limpid as urine, but of a coffee colour. In other cases it has been ammoniacal and offensive. In Dr. Hillier's case the fluid withdrawn from the cyst during life was fœtid, highly albuminous, and contained urea; that removed after death was clear, pale, urinous in smell: it contained a mere trace of albumen, and had a specific gravity of 1002.[1] Mr. Cooper Rose has described a case of hydronephrosis which was tapped, with the result of a permanent fistula and the habitual issue[2] of a fœtid discharge, in which none of the elements of urine could be detected. In Mr. Cæsar Hawkins's case, elsewhere referred to (p. 859), where the cyst was virtually external to the kidney, however closely connected with it, the absence of special urinary constituents was ascertained by Dr. Prout; and it may, perhaps, generally be inferred that if aqueous or simply serous fluid, not obviously putrid, be found to be free from urea, it is not from a hydronephrosis. If the cavity be altered by suppuration, the contents may be either such as have been described, more or less mingled with pus, or may be simply purulent, the pus possibly not differing appreciably from pus formed in other situations. A truly hydronephrotic cavity may become filled with a gelatinous material, having all the characters of colloid cancer, as in the case already referred to, and in another of the same kind which has since been published by Damreicher. Cholesterine has been found in the fluid of hydronephrosis.[3]

Symptoms of double hydronephrosis.

The symptoms of hydronephrosis, when it is congenital and double, are—to place them in the order in which they present themselves—possibly difficult labour, abdominal tumour, absence of urine, and death, unless the urethra can be made pervious within perhaps two days of birth. If the obstruction be incomplete, in which case it may long escape notice, the disease may not cause death until much later. Instances have been published by Broadbent, Faber, and Little, in which distension of both kidneys with their ducts, of congenital origin, proved fatal at the ages respectively of three months, 5½ and 6½ years. The case fatal at the age of 5½ was so suddenly, after a fall; with that at 6½ death was preceded by convulsions and coma. The chief symptom in all was abdominal swelling; one which was subsequently tapped was at first thought to be ascites.

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[1] *Med.-Chir. Trans.* vols. xviii. and lii.

[2] *Ibid.* vol. li.

[3] Dr. Coghill, *Edin. Med. Journ.* Feb. 1875, p. 747.

When hydronephrosis presents itself later, its course is ruled by that of the disease upon which it is dependent; if unremoved or irremovable stone in the bladder, it is early fatal; if on diabetes insipidus, it but little interferes with life. When double hydronephrosis ensues as the result of calculi in both kidneys, as in a case recorded by Rayer, or of obstruction in both ureters, as is not uncommon, death may occur by uræmia, with or without total suppression of urine. In a case published by Dr. Roberts, in which one ureter was compressed by a branch of the renal artery, the other narrowed by an old stricture, death was preceded by sixty hours of suppression. It is not necessary to describe the swellings of double hydronephrosis, save as cysts in the renal positions and with renal characters which have been sufficiently dwelt upon in the general consideration of renal tumours. Double tumours seldom attain the dimensions of single dilatation; they are often of unequal size; one often evident during life, the other not so. In one of Rayer's cases the right kidney formed a sac eight inches by five, the left a small membranous sac not discoverable until after death. In others, particularly where the obstruction has been in the urethra, both have been voluminous. The more or less persistent swellings of double, as of single hydronephrosis (excluding, that is to say, distensions like those of diabetes insipidus, which are habitually relieved with micturition), so frequently intermit, either spontaneously or under pressure or friction, as to be importantly characterised by their thus becoming relieved by urinary discharge. Out of the sixty-nine cases of hydro- and pyonephrosis, upon which this account is chiefly based, subsidence of the tumour occurred spontaneously in twelve cases, under friction in two. In one of the instances the discharge was by the rectum, in the rest ascertainably or presumably by the urinary channels. This occurrence is more frequent with hydro- than with pyonephrosis; in the cases of the latter it took place but once. It is relatively more frequent with double than with single hydronephrosis; among the sixteen cases of double hydro-nephrosis this phenomenon presented itself either once or repeatedly in six patients; among the forty-three of single hydronephrosis it occurred in seven. This habit of renal accumulation, to which especial attention has been drawn by Mr. Morris in the paper already referred to, is obviously to be associated with the incompleteness of the stoppage which usually gives rise to the disorder.

Intermission of hydronephrotic swellings.

To revert to double hydronephrosis, the general symptoms, apart from the swellings, are various; and, excepting the forms of uræmia and constipation from pressure on the descending colon, may be called accidental. Febrile disturbances, or signs of prostration described as febrile, have been noted in some cases; in others the more definite results of uræmia, vomiting, convulsion, and coma. Pain in the back and other immediate signs of urinary disturbance sometimes present themselves, and also thirst and frequency of micturition, as the results of the state of renal secretion which belongs to the dilated condition of the glands. The urine when it finds exit is usually pale, copious, of low specific gravity, and often with a trace of albumen. It has been found to contain blood and epithelium of pelvic characters. It is liable to occasional suppression and sudden, often large, increase from the overcoming of an uretral obstruction.

Urine with hydronephrosis.

It is not necessary to refer to the urine of *single* hydronephrosis, which, except at the times of intermittent discharge should these occur, is solely supplied by the undilated kidney, and is healthy if this be so. It may be albuminous, bloody, or purulent, as the result of disease in the practically solitary organ.

Single hydronephrosis.

When hydronephrosis is limited to one kidney, the cystic transformation of the organ and consequent abdominal swelling may be greater, as already stated, than is consistent with life where both are involved. The greatest on record is Mr. Glass's, already referred to, where the abdomen measured six feet four inches in circumference, the cyst held thirty gallons, the heart was pushed up to the clavicle, and the lungs reduced by compression to the size of those of a new-born child. The patient was described as a tall, well-proportioned woman. She died at the age of twenty-two. Smaller, but still considerable, degrees of abdominal swelling from single hydronephrosis are matters of familiar experience; and in many cases have involved both sides of the abdomen. I estimate that, in about one-fourth of the cases of single hydronephrosis, the swelling, as observed during life, has ceased to be limited to the lateral half of the body, while, in perhaps a third of these, it has come to occupy the greater part of the belly. When the cyst has transgressed the limits characteristic of renal tumours, the dilatation has become great, the walls attenuated, and the fluidity of the contents obvious. In these circumstances it has been mistaken for ascites, and often for ovarian dropsy. In Dr. Hillier's[1] case at the Hospital for Sick Children, the swelling was at first thought to be of this nature, so large, so symmetrical was it, and so superficially did it fluctuate; its nature was first suggested by the character of the fluid withdrawn, which, though albuminous, was urinous in smell, and contained urea and uric acid. The ovarian error is more frequent and more important. I have before me records of seventeen cases of single hydronephrosis in females: in eight of these the tumour was thought to be ovarian,

Swelling.

Errors in diagnosis. Taken for ascites;

for ovarian tumour;

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[1] *Med.-Chir. Trans.* vols. xlviii. and lii.

in five ovariotomy was proposed, and in four attempted.[1] To refer to pyonephrosis in this connection, though somewhat out of order, this error of diagnosis is somewhat less frequent: with five female subjects it occurred but twice.[2] When once such a mistake is recognised as one to be guarded against it should cease to be possible. The depression of the uterus with the renal cyst, as compared with its elevation with the ovarian, should suggest further inquiry, part of which should be by puncture and examination of the fluid for urinary constituents. A renal indication second to none in reliability, but not always present, is the abrupt variation of the tumour in size with or without noticeable discharge with the urine. But I need not recapitulate the distinctions elsewhere stated between renal and ovarian tumours. Another error of diagnosis has occurred in the mistaking of a right hydronephrosis for hydatid of the liver, and the tumour in this belief[3] been repeatedly tapped and injected with iodine. The distinctions between hepatic and renal tumours have likewise found mention elsewhere.

for hydatid of liver.

One of the most important characters of renal dilatations, whether hydro- or pyonephrotic, is intermission by discharge into the urine, whether spontaneously or under pressure or friction. It has been already shown that these expansions usually result from incomplete closures; the consequence is, that when a certain degree of fulness and of tension is attained, or a valvular obstruction is so stretched as no longer to act, there is an escape, partial or complete, of the accumulation. The addition to the urine in these circumstances may attract notice, as imparting to it some unusual character; but more often a simple increase is observed, or the urinary change wholly eludes observation. The intermitting habit of these tumours has already been noticed in connection with double hydronephrosis. The accumulation of hydronephrosis when on the left side has been known, like accumulations of pus, to enter the descending colon, and thus escape by the rectum.[1]

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[1] I need make no individual reference to these, as most of them are referred to in Mr. Morris's paper, my obligation to which I have already acknowledged. See *Med.-Chir. Trans.* vol. lix.

[2] Cooper Rose, *Med.-Chir. Trans.* vol. li. p. 167.

[3] Dr. Farre, *Lancet*, 1861, vol. ii. p. 472.

Symptoms of single hydronephrosis.

Slightly to sketch the remaining symptoms of single hydronephrosis, it is first to be noted that, so long as the other kidney be healthy, there may be none apart from the tumefaction, and this may not be such as to attract notice. There is at St. George's Hospital a kidney dilated, as the result of stone, into a cyst, which must have held nearly a gallon, and reached from the pelvis to the diaphragm. This was taken from the body of an aged clergyman, of whom it was said that he had never had a day's illness, nor any symptom to draw attention to the tumour, until two or three days before his death. He had been a great walker, and was well known in his neighbourhood by a peculiarity of gait, as if from spinal curvature.

The symptoms which in other cases have presented themselves have been occasionally, but rarely, pain in the lumbar region and retraction of the testicle as if from stone, though no stone was present. The more serious results of uræmia do not occur so long as the other kidney is healthy, though repeated vomiting, whether arising in this or otherwise, has been known, as also has an urinous smell from the skin, the result of absorption from the cyst and cutaneous excretion. Hydronephrosis may cause death by discharge through the bowel, as in a case already referred to, or by rupture into the peritoneum, with consequent peritonitis and collapse.[2] But the greatest dangers which hydronephrosis entails are in the surgical procedures which it suggests, chiefly by its deceptive resemblance to ovarian disease. In the collection of cases I have referred to are four in which death was caused by attempted ovariotomy; four in which it followed upon tapping, which, in two instances, was performed in the belief that the cyst was ovarian.

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[1] Gintrac, *Sydenham Society's Retrospect*, 1867 and 1868, p. 175.

[2] Mr. J. Thompson, *Path. Trans.* vol. xiii. p. 128.

If hydronephrosis of one kidney be accompanied with disease of the other,[1] as in an instance in which the dilatation on one side, the result of calculus, was conjoined with obstruction by calculus of the opposite ureter, fatal suppression of urine may ensue; but that the disease is not one of rapid or large mortality is evident from the fact that about one-third of the patients that present themselves die of causes unconnected with it. The annexed abstract gives the causes of death in twenty-eight cases in which they were explicitly stated.

Causes of Death in twenty-eight cases of Single Hydronephrosis.

Imperforate anus	1
Suppression of urine	1
Uræmia	1
Vomiting	1
Diarrhœa	1
Wasting	1
Dyspnœa, &c., from pressure of cyst	1
Peritonitis from perforation of cyst	1
Discharge of cyst into rectum	1
Attempted ovariotomy	4
Results of tapping	4
Suppuration in kidney after operation in bladder	1
Accidental injury unconnected with renal state	3
Disease unconnected with renal state	7
	28

Duration.

The range of duration of single hydronephrosis is, as must have been already inferred, nearly as wide as that of human life. Of eight cases in which the disorder was apparently congenital, death occurred at birth in one; during the first year in four; in one at the age of eight; in one at twenty-two; in one at thirty-two. Of twelve cases in which the disorder was acquired subsequent to birth, the time between the first recorded symptom and death, often an obviously insufficient expression of the duration of the disease, was in one case 'a few days;' in two a year; in four between one year and four years; in two between four years and ten; in one 'many' years; in one thirty-two years; in one forty-two years.

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[1] Rayer, vol. iii. p. 490.

Pyonephrosis.

Pyonephrosis is dilatation *plus* inflammation of the pelvis; hydronephrosis, dilatation without inflammation. The dilatation may come first, and the inflammation afterwards, as in the ordinary occurrence of a hydronephrotic cavity becoming the seat of suppuration, either as the result of tapping or spontaneously, in which case hydronephrosis and pyonephrosis are but the earlier and later stages of the same disease. Or the inflammation may precede or accompany the dilatation, as when a stone sets up pyelitis, and subsequently, or at the same time, obstructs the exit. In this case we have pyonephrosis *ab initio*, independently of hydronephrosis.

The symptoms of pyonephrosis are more urgent, its course more rapid, and death more often its direct result, than is the case with hydronephrosis. It is due in a larger proportion of cases to calculus (see p. 819), a loose body within the urinary cavity being suited to cause irritation as well as obstruction.

With pyonephrosis the symptoms of suppuration, whether with the discharge of pus or of its retention, are superadded to those of hydronephrosis. Lardaceous disease is common as a result of the chronic discharge, while in other cases the patients have become hectic and sunk without this adjunct. In other instances there have been rigors, with the intermittent fever of septic or purulent absorption, not, however, going so far as the establishment of pyæmia or secondary abscesses. The suppurative process sometimes extends beyond the kidney and penetrates the bowel, usually the descending colon, the affected kidney being the left; and it has been known to extend backwards and cause erosion of the spine, as in an instance within my own experience, where a large collection of pus in connection with a calculus was in contact with the denuded transverse processes of the second and third lumbar vertebræ. No paraplegic symptoms were noted, but it was obvious that, with a little further extension the cord would have been involved. Further particulars as to the extension of suppuration of renal origin will be found in the chapter on 'Perinephritis.'

Treatment of hydro- and pyo-nephrosis.

In treating *hydronephrosis* it is necessary to bear in mind its slow progress and small mortality. Produced, as the secretion is, with less force than that of ovarian cysts, it is more easily arrested by the pressure it naturally encounters; the tendency to increase is smaller, and the need for interference less imperative. The spontaneous occurrence of discharge by the ureter so frequently noted, and the almost invariable fact that with hydronephrosis this channel is only imperfectly closed, afford much encouragement to the use of friction and pressure. As long ago as the year 1837,[1] it was put on record that a tumour in the abdomen of an infant, afterwards found to have been formed chiefly by a great dilatation of the ureter, altered in size when rubbed, the bladder at the same time swelling under the hand.

Pressure.

Dr. Broadbent[2] related at the Pathological Society the case of a large double hydronephrosis of congenital origin which completely subsided, with profuse discharge of urine, under friction with the ointment of iodide of potassium, and judiciously infers that the result was due rather to the friction than the ointment. Dr. Roberts completely emptied an unilateral cyst of this nature in a child by diligent manipulation every other morning with a lubricating ointment; and it is an obvious suggestion that re-accumulation might be prevented by a suitable pad secured by a bandage or truss. When the cyst has become so large, as in Mr. Glass's case, as to encroach upon the organs of respiration, or otherwise cause dangerous pressure, or, as in one recorded by Mr. Thompson, to be painful when distended, it may be necessary to draw off the fluid. Most of the cases in which this has been done have been anterior to the aspirator, and the results less satisfactory than would probably now be the case. I have before me

Tapping.

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[1] Mr. Thurnam, *Lond. Med. Gaz.* vol. xx. (1837) p. 717. Quoted by Mr. Morris, *Med.-Chir. Trans.* vol. lix.

[2] *Path. Trans.* vol. xvi. p. 164.

the particulars of fourteen cases in which a renal cyst, holding an aqueous or purulent fluid, was tapped once or repeatedly: in six a fatal result was immediately due to this operation, in four by way of escape and peritonitis; in one case death occurred only after fifteen' years discharge through a fistulous opening thus established; in seven, the operation was unattended with injurious results. Tapping was executed often on a false hypothesis: in one instance, as was supposed, for ascites; in one for hydatid of the liver; in four for ovarian disease. I presume, however, that, when the organic site of the disease is clear, the ureter closed, and the accumulation purulent, it would be right to relieve it from the loin, notwithstanding the results which have attended abdominal tapping. The proper course would probably be to aspirate from behind, post-peritoneally, after having found the matter by tentative puncture with a capillary tube. Dr. Coghill tapped[1] a hydronephrotic cyst from the loin behind the peritoneum, with the discharge of over four pints of aqueous fluid. The patient, as I learn from Dr. Coghill, was apparently cured by the operation, for she is now (1882) alive and well.

I may subjoin an interesting case of hydronephrosis, the result of an injury, in which aspiration was successfully employed by Mr. Croft.[2]

A boy, twelve years of age, while jumping over another boy's back, fell and hurt his left side and loin. This was followed by pain in the left side, and hæmaturia, at first to port-wine colour, which lasted five days. Forty-nine days after the accident a fluctuating swelling was found in the left lumbar and hypochondriac regions, which quickly extended into the epigastric. This was tapped with the aspirator, near the tip of the eleventh rib, and seventy-nine ounces of urinous fluid withdrawn.

In eight days the operation was repeated, with the removal of thirty-eight ounces of similar liquid. During the following three months the puncture was repeated six times, never less than three pints, or more than four, being drawn off. On the last occasion the fluid contained a large quantity of albumen, whereas at first there had been only a trace. After this there was no re-accumulation, and the cure was complete. Mr. Croft suggests that the original lesion was of the pelvis of the kidney and the stoppage of its exit, the result of adhesive inflammation. It would seem probable, from the profuse and continued hæmorrhage, that the kidney was torn in addition, and it may be at least doubtful whether the obstruction was by adhesion or by clot.

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[1] *Edin. Med. Journ.* Feb. 1875, p. 747.

[2] *Clin. Soc. Trans.* vol. xiv. p. 107.

Excision of cyst.

The question next arises as to excision of the cyst, whether hydro- or pyonephrotic. This has been performed in a considerable number of cases, some of which were known to be renal, many supposed to be ovarian. We are indebted to Mr. Barker[1] for valuable tabular statements, which represent the published experience on this subject up to March 1881. Mr. Barker has collected fourteen instances in which renal cysts or dilatations have been removed: eight by abdominal section, with five deaths, and three recoveries; six from the loin, with four deaths and two recoveries.[2] In five of the cases of abdominal section the tumour was thought to be ovarian; three cases were operated on knowingly as hydronephrosis, all by abdominal section, with one death; three were operated on knowingly as pyonephrosis, all by lumbar section, with two deaths. Thus it would appear, so far, that the mortality attending the removal of diagnosed renal cysts is fifty per cent. The condition found in the fourteen cases referred to was described as hydronephrosis in three, with one of which sarcoma was conjoined; as pyonephrosis in two. There were seven in which dilatation and sacculation were found, but which cannot be definitely ascribed to one category or the other, though it is probable, from the frequency of calculus among them that most would have fallen under the description of pyonephrosis. Four cases were of renal cysts of uncertain character.

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[1] *Med.-Chir. Trans.* vols. lxiii. and lxiv.

[2] See cases by Czerny, Thornton, Couper, Barker, and Lange. See paper by Barker, *Med.-Chir. Trans.* vol. lxiv.

As might be expected the excision of renal cysts presents itself as more successful when performed intentionally than by mistake; but, in any circumstances, the operation involves too much risk to be recommended unless more than ordinary danger be involved in the progress of the disease. Hydronephrosis, chronic and comparatively harmless as it is, can scarcely justify such hazards as are properly incurred in dealing with an ovarian cyst; and as compared with ovariotomy, it is probable that the dangers of removing a large renal cyst through the abdomen will always be the greater. But when the collection is purulent, from stone or otherwise, danger may threaten, whether by exhaustion or extension, which may warrant the operation, though, as far as we yet know, those are greater than are incurred when aqueous distension is in question.

I have recently been informed by my colleague, Dr. Barlow, of a successful excision, in a case of pyonephrosis under his care, performed by Mr. Cowper. The patient, a girl of sixteen, in good general health, had lumbar pain, passed highly purulent urine, with much frequency, and displayed a tumour in the right renal region, which was traversed by bowel. Nephrectomy was performed through the loin, with the removal of a thin-walled suppurating cyst which represented the kidney. There was no sign of tubercle or caseation about it, nor any evidence as to the cause of the dilatation. The patient had perfectly recovered by the following August.

CHAPTER X.

CYSTIC DISEASE OF THE KIDNEY.

Cysts as closed cavities within the renal substance are sufficiently distinct from the cystiform dilatation of the hollow organ to which the term hydronephrosis is given. And it must be needless to refer to the essential differences between the cysts in question, which are for the most part transformations of the proper elements of the organ and those of parasitic origin, which will find consideration elsewhere.

Classification.

For practical purposes renal cysts may be thus classed :—

1. Minute cysts which occur as part of some other form of renal disease, more especially the interstitial, and occasionally present themselves in kidneys ostensibly healthy.

2. Large and numerous cysts which give rise to great increase of size of the affected organs; these may be congenital or acquired after birth.

3. Large cysts which are solitary, or only accompanied by a few others, usually of minute size. These may be similar in nature to those previously mentioned, or may be connected with malignant or other disease.

4. To these must be added cysts which may be termed *paranephric*, which involve or impinge upon the kidney from the outside.

THE LARGE CYSTIC KIDNEY AS A DISEASE OF EXTRA-UTERINE LIFE.

I do not now propose to deal with the renal cysts, usually of small size though often in considerable numbers, which present themselves as the concomitants of other renal changes to which they play only a secondary part; these have found mention in connection with the types of renal disease to which they belong (see page 368): I refer at present only to the *large cystic kidney*, in which the vesiculation transcends all other changes, and produces such increase of bulk that the organs may fairly be considered as abdominal tumours.

Naked-eye changes.

The kidneys are transformed into collections of cysts so completely, in well-marked cases, that it is difficult to discern with the naked eye any remnants of the proper tissue, though with the microscope this is always to be abundantly found, however its ordinary semblance may be destroyed by extension and distortion. The increase of bulk is usually great, though the renal shape is more or less preserved, as if the addition of substance were distributed with some uniformity. Such kidneys often measure ten inches in length, and weigh two or three pounds each. Two at St. George's Hospital, described by Dr. Whipham in the twenty-first volume of the 'Pathological Transactions,' weighed eighty-one and three-quarter ounces, another pair from a patient under the late Dr. Page weighed six pounds ten ounces, while the maximum of bulk was reached in a case placed on record by Dr. Hare,[1] in which the left kidney weighed sixteen pounds and measured fifteen and a quarter inches in length, while the right was enlarged, but only to double its natural size.

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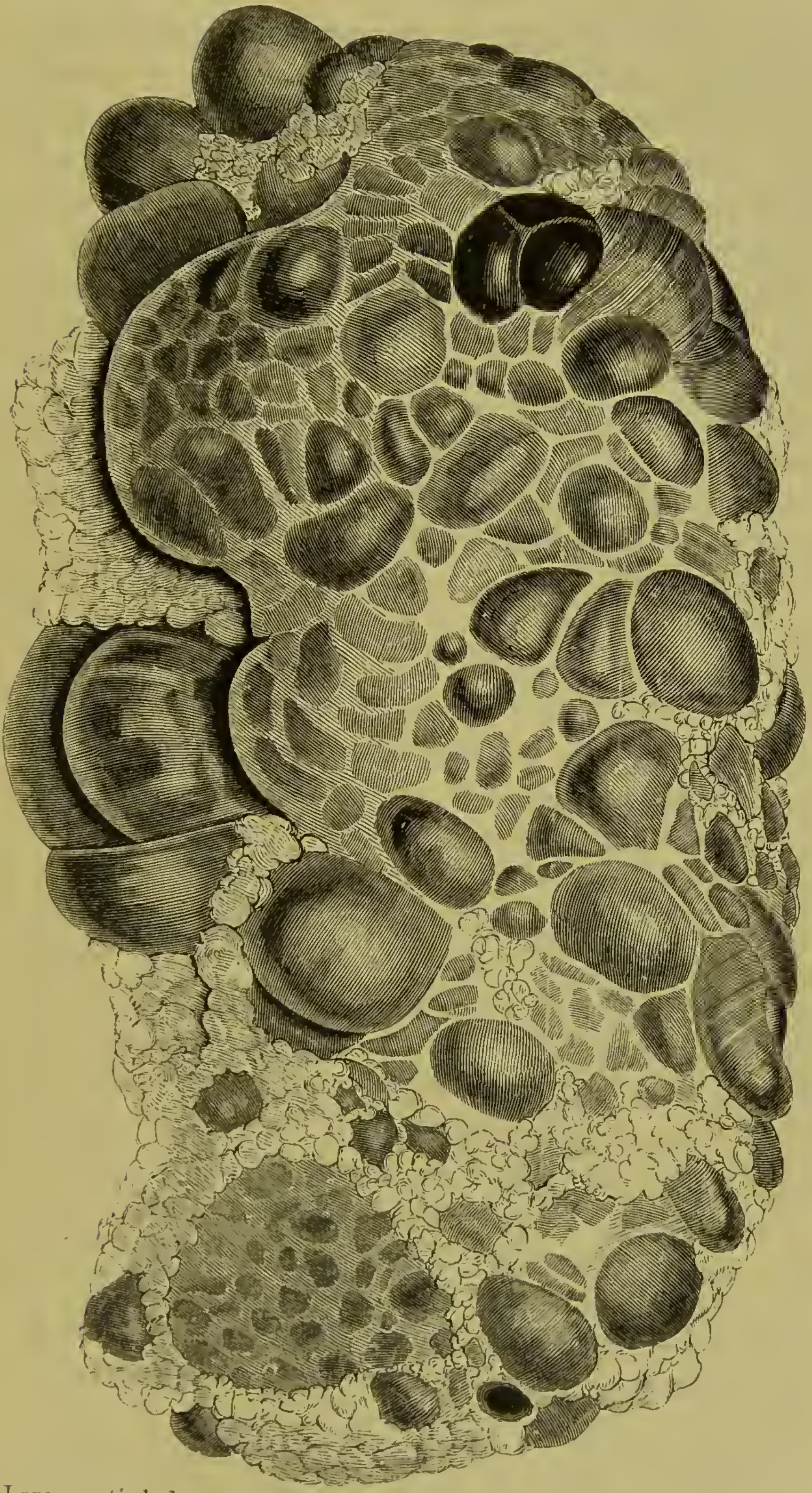
[1] This remarkable case is recorded by Dr. Hare in the *Path. Trans.* for 1850–51. By a printer's error it is stated that '*some* of the cysts contained hydatids.' I have Dr. Hare's authority for stating that for *some* should be read *none*. The case is therefore unequivocal, and is of great interest.



Large cystic kidney, one of a pair which weighed eighty-one and three-quarter ounces, referred to on preceding page. (From a patient in St. George's Hospital, under Dr. Wadham, reported by Dr. Whipham.) 'Path. Trans.' vol. xxi. p. 245.

The cortical substance, and to a less extent the cones, are replaced by cysts which vary in size from the smallest distinguishable by the naked eye—while smaller still are shown by the microscope—to the bulk of walnuts as is common, or even much beyond this. In Dr. Hare's case the largest cavity held more than half-a-pint. The cysts protrude from the surface as circular bosses, raising the capsule, which, together with the cyst-wall, is so transparent that the variously coloured contents can be seen from without. The external appearance roughly resembles that of a water-worn mass of conglomerate or pudding-stone, the prominent pebbles representing the cysts. On section, the globular or ovoid cavities are seen to be crowded together and altered in shape by apposition, nothing being easily recognisable of the renal tissue, except here and there the remnant of a cone. These structures, however, as already stated, are not exempt from the morbid transformation, though less affected than the cortex. Within them cysts are often to be seen, though smaller and less numerous than elsewhere. The cysts, wherever found, appear to be lined with a translucent membrane, which is smooth, except that in the larger cavities it may display shallow folds or creases. Their contents are various in colour and kind: they are generally pale or deep yellow, and highly albuminous; often viscid, treacly, or even colloid; they are sometimes purplish, variously blood-tinged, purulent, or caseous; epithelial cells and renal tubes have been found in them, sometimes uric acid, cholesterine, or triple phosphate. The pelvis and ureter are commonly free from dilatation, though this alteration to a slight extent has in some cases been recorded. I have occasionally noticed that the pelvis has been stretched with the dimensions of the organ, but undergone no increase of capacity.

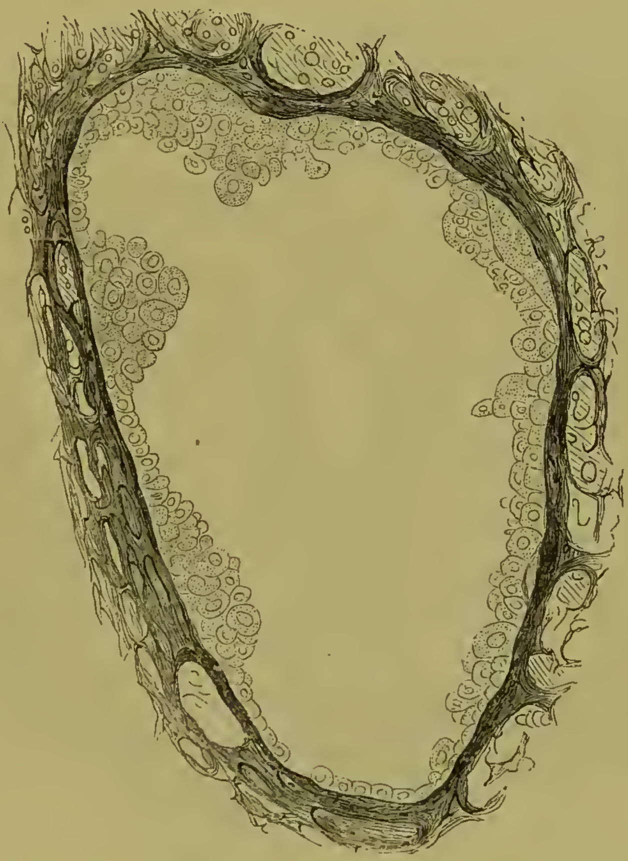
Cysts;

their contents.

Both kidneys are usually affected. I find that among twenty-six cases of which the morbid appearances are fully recorded, there was only one in which the disease was not obviously bilateral, though often more advanced on one side than the other. In the single exception[1] many of the tubes of the apparently unaffected kidney were found to be denuded and dilated, changes which, as will be presently seen, are part of the cyst-forming process.

Microscopic appearances.

I have made translucent sections of as many large cystic kidneys as I have been able to obtain, including fresh specimens, and others that have been preserved in spirit, some as taken from the body, and some after minute injection of the arteries; the results are as follows: The cysts are globular, ovoid, or somewhat irregular closed cavities which range upwards in size from about the normal diameter of tubes to sizes which are beyond the comprehension of the microscope. They lie for the most part among the convoluted tubes, but occasionally among the straight, closely surrounded, wherever they be, by the



Cyst from large cystic kidney, showing its epithelial lining.

Cysts;

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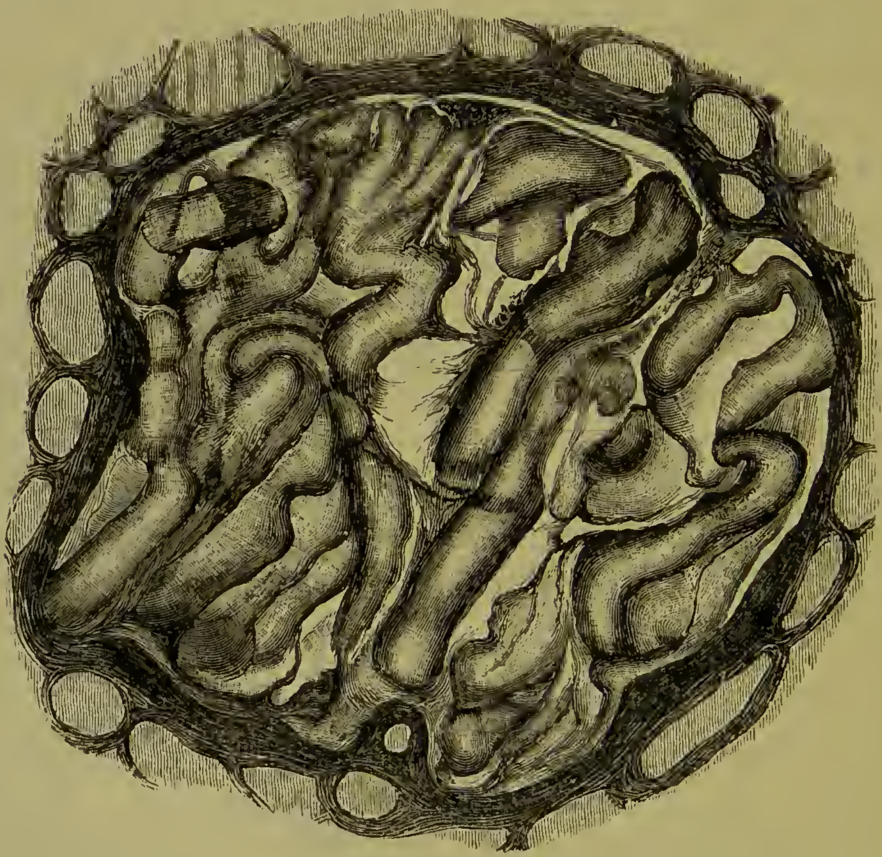
[1] Dr. Conway Evans, *Path. Trans.* vol. v. p. 183.

proper structure of the organ. The boundaries of the cysts or cavities often appear to be formed only of exposed and condensed renal tissue, though in some instances this is seen to be lined by a delicate layer of epithelium, a basement membrane beneath it being a matter rather of inference than demonstration. The epithelial cells are of small size, but mostly solid figure, such as might have been derived with little alteration from the tubes. Occasionally they are flat. The thin, almost imaginary, walls of the cysts are in marked contrast with the thick coats of the neighbouring blood-vessels. The cysts, as seen under the microscope and in section, are generally empty, especially those of large size, while the smaller are sometimes filled with a translucent, structureless material, which hardens in spirit or chromic acid, so as to retain its place in thin sections. In three specimens I have found contents which



Cyst in large cystic kidney filled with detached, crumpled, and denuded tubes.

Their contents.

were at first sight puzzling, but which I think can be accounted for without improbability. The cysts or cavities I refer to, which are comparatively seldom met with, are of small size, perhaps four or five times the diameter of a Malpighian body, and contain tubes detached from their surroundings, and either little altered or, as in the woodcut (p. 846), crumpled and denuded. I have seen such tubes as in the illustration, comprised within a regular cyst, or in other cases sticking raggedly out of the walls of a broken cavity. The appearances suggest that the cavity in each case has resulted from a local destruction of tissue rather than by mere distension of any existing structure; the frequent absence of lining membrane corroborates this view. Supposing a tube to burst in the process of distension, it might give rise to such appearances as have been described—a somewhat indefinite cavity would be formed, into which surrounding tubes might protrude or fall. With time the cavity might acquire, as in the woodcut, a regularly cystic outline.

Malpighian bodies.

The tubes and Malpighian bodies lie, as has been intimated, in close apposition to the cysts; the Malpighian bodies are often close to the cavity, and even protrude into it, as if some process of destruction had worn away the less resistant parts of the glandular structure; but they are clearly normal in character and position, as if any association they might present with the cavities were accidental. The most noteworthy condition of the tubes about the cysts and in cystic kidneys elsewhere is irregular dilatation. This may be more or less general, so as to give to the section an almost honeycombed appearance, or limited to certain tubes, whether convoluted or straight, which are conspicuous by their solitary enlargement, and are often densely plugged with epithelium or blood. These are often of such size—many times the common diameter of tubes—that, when seen in transverse section, it requires care to determine whether they be tubes or cysts. A longitudinal view is of course conclusive, but when this cannot be obtained, it is often impossible to say

Tubes.

whether one is looking at a tube or a cyst, so close may the resemblance be.

Fibrosis.

There is often about the cysts and the kidney containing them much hypernucleation and fibrosis; usually not general, as with the granular kidney, but scattered or partially distributed. The blood-vessels of the organ appear, both in injected and uninjected specimens, to be, like the Malpighian bodies, natural; they have no special relation to the cysts, though they often pursue an uninterrupted course right up to the edge of the cystic cavity, as if this were a mere broken hole, without any separation between the surrounding tissue and its cavity. Less frequently capillaries can be traced in circular arrangement around the slender cyst-wall.

Inferences from morbid anatomy.

The cysts in question, unaccompanied as they are with any formation foreign to the kidney, are necessarily but an alteration of it, either by destruction of its tissue or transformation of its elements. I have shown reason to suppose that some at least are attended with destruction of tissue, but the majority are obviously the results of transformation. I have seen nothing to justify a view which has been advanced, that they are excessive and peculiar overgrowths of the epithelia. I have never seen a cyst within a tube, however often they appear to replace tubes. The choice lies between transformation of the tubes and of the Malpighian bodies. With regard to the Malpighian bodies, it is beyond doubt that these are sometimes dilated as the result of interstitial disease, though not so far as I have been able to make out, to much beyond microscopic limits (see woodcut, p. 370). In large-cysted kidneys, I have never been able to satisfy myself that any of the cysts had this origin. The Malpighian bodies are evidently unconnected with the cysts, though often in apposition to them, and display no change, save that rarely a capsule may be a little dilated, as is so often seen in other forms of renal disease. The presence of cysts within the cones, where no Malpighian bodies are, is evidence that in this situation at least they have no such

Origin of cysts;

origin. There is a large cystic kidney at the College of Surgeons (1902A), of which the cysts are stated in the catalogue to be formed by enlargement of the Malpighian capsules, within which the Malpighian tufts were seen. By the courtesy of Professor Flower I was enabled to examine this preparation. The Malpighian bodies were generally natural; the cysts clearly had no association with them except that of accidental contiguity; in some cases the Malpighian body lay in the wall of the cyst, clearly separated from its cavity by the undilated Malpighian capsule, virtually external to the morbid process however near to it. It cannot be doubted that the cysts are, as a rule, altered tubes; whatever uncertainty there is, is only as to the manner in which the change has been wrought. The epithelial lining of the cysts, the tenuity of their walls and their resemblance to the walls of tubes, the presence of the cysts wherever tubes are found, the frequent arrangement of these morbid formations in line, and their containing urinary constituents, together furnish apparently conclusive evidence. The mode of their formation can scarcely be but by constriction, closure, and final obliteration of the tubes at certain points between which secretion continues, but cannot escape. The only appearances suggestive of obstruction which such kidneys present are ordinary tubal distension, not to be distinguished from that of ordinary tubal nephritis, and, what is more constantly present—indeed, it occurs without exception, as far as I have seen—intertubal overgrowth, with consequent constriction of the tubes; if there be any other cause of obstruction it is either transient in its nature, or not such as to present itself to microscopic examination.

not in Malpighian bodies,

but in tubes.

To complete the pathology of the cystic kidney by reference to associated changes, cysts, roughly speaking of a similar nature, have been found in the liver and spleen, though so infrequently that it may be doubted whether the connection is more than accidental. Special attention has been drawn to this concurrence in the 'Pathological Transactions,' by Dr. Bristowe in the first place, and later

Cysts in other organs.

by Drs. Wilks and Pye Smith, and four examples there recorded, in which the liver was cystic together with one or both kidneys, and one in which the spleen was affected together with the kidneys. Including these, there were among the total of thirty-three cases of the cystic kidney, five in which the liver was thus affected, one in which the spleen was affected; but it is not probable that cysts in other organs actually concur with those in the kidney in nearly so large a proportion as this represents; for the cases of concurrence have been especially sought for and brought together. The origin of the cysts in the renal tubes, of which no doubt can be entertained, is enough to dissociate their nature from such as arise in organs which, like the spleen, have no secreting ducts, or, like the liver ducts, which are so dissimilar to those of the kidney that they can scarcely be supposed to share the same diseases. The cysts in the liver have generally been small, seldom numerous; they have been supposed by Dr. Lionel Beale[1] to originate in a change in the hepatic cells, which Dr. Pye Smith defines as vacuolation. It is sufficiently clear that the cysts do not depend on any new growths common to several organs, but are modifications of the organs themselves, probably different in each situation, and connected remotely, if at all.

Hypertrophy of heart.

To complete as much of the morbid anatomy of the disease as may be considered apart from its progress and termination, the heart has in many cases been found to be hypertrophied, as with the granular kidney. In three instances which occurred at St. George's Hospital, this organ, which was enlarged chiefly in the left ventricle, and without the occurrence of valvular disease, though in one of them the aorta was noted as atheromatous, weighed respectively twenty-three ounces, twenty-two and a quarter ounces, and nineteen ounces. The state of the heart, therefore, is much what it would have been had the kidneys exhibited the ordinary form of granular degeneration instead of cystic transformation and enlargement. The whole morbid anatomy of the disease points to the inference that, although it is possible that in some cases the cystic change may be due to obstruction by tubal nephritis, yet, as a rule, it is due to a form, perhaps a peculiar form, of interstitial fibrosis. Evidences of this overgrowth are always abundantly present, and appear sufficient to account for the cystic conversion, while no distinction in kind, however much in degree, is to be recognised between the small and scattered cysts, so common in the contracted granular kidney, and the gigantic and innumerable chambers which produce the cystic enlargement.

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[1] Dr. Lionel Beale, examination of case recorded by Dr. Bristowe, *Path. Trans.* vol. vii. p. 234. Dr. Pye Smith, *Path. Trans.* vol. xxxii. p. 112.

Clinical particulars.

The clinical outline which follows is chiefly founded upon an analysis of thirty-three cases, ten of which have been obtained from the records of St. George's Hospital, two relating to patients of my own in that institution. The rest were obtained from other hospitals and pathological collections, and various publications.

Sex and age.

The subjects of the enlarged cystic kidney are more often males than females, in the proportion of 21 to 7, judging from 28 cases which afford information in this particular. They are always adults (I am not now considering the congenital cystic kidney, fatal about or before birth): the ages at death varied in 21 cases from 20 to 98 years. In five instances death occurred between the ages of 20 and 29; in one between 30 and 39; in eleven between 40 and 49; in five between 50 and 98. It thus presents itself as an acquired chronic disease somewhat resembling in its incidence the granular kidney. The mortality between 40 and 49 is noteworthy in this light; and scarcely less so its early period of fatal activity between 20 and 30, which may correspond with those cases of early granular kidney which are due to scarlatina and the other affections of childhood.

Causes.

As with granular degeneration, the causes of cystic enlargement are obscure, and its beginning unmarked. Gout has not presented itself in the cases from which

I have drawn. Tuberculosis, generally in the form of phthisis, was present in five cases of twenty-eight of which details are given; not often enough to indicate any pathological association. In two cases the disease followed a blow or injury; in one it was attributed to cold.

Its frequent latency.

The disease, which is usually latent until an advanced stage is reached, not unfrequently remains so until revealed by *post-mortem* examination; this was so in nine of twenty-five cases of which I have histories. When the disorder is declared, it is usually by symptoms which are so nearly those of the granular kidney that it is only by the presence of the renal tumours that a sure distinction can be made. The differences are chiefly these: With the large cystic kidney there is almost no tendency to dropsy, while pain in the loins is more obtrusive, and hæmaturia more frequent and profuse, than with the more common form of disease. The latter distinction is strongly marked. Dropsy, whether superficially or in the serous cavities, appears to be generally absent. A patient under my own care was said to have had swelling of the legs, but when I saw him there was none. The only recorded case I have met with in which œdema was mentioned, presumably as a result of this disease, was that of the gigantic cystic kidney recorded by Dr. Hare (see p. 842). In this it is probable that the swelling was due more to the mechanical effect of the tumour than to the constitutional influence of the disease. The œdema was most marked on the side to which the renal swelling was nearly limited.

Distinctive symptoms.

No œdema.

Urine.

The urine furnishes the most marked evidence of the presence of the disease, though not of its kind. It has the characters which belong to the granular kidney. It may possibly be normal, as with the earlier forms of this disorder. Dr. Conway Evans has described an instance in which this secretion was natural, and the large cystic kidney found to exist. But there are few exceptions to the rule that, with the advanced disease, it has been found to be albuminous if examined, though in many cases the urine and the disease have alike escaped notice. The albumen has varied from a small amount up to about two-thirds. The urine has usually been pale, copious, of low specific gravity (in one instance down to 1005), and has been found to contain casts, as in a case under my own observation, of the coarse granular variety. It is characterised in most cases by the frequent admixture of blood, often so copiously as to call for styptics. Of sixteen cases in which symptoms were present, hæmaturia was prominent in eleven. In some it largely contributed to death by the exhaustion it caused; in others it gave trouble by the formation of coagula, which were passed with difficulty; and in one it helped to produce suppression by the blocking with coagulum of one ureter. In a few instances small amounts of pus have been found.

Hæmaturia.

The pathognomonic feature of the disease is the double tumour, a sign generally unfound and unsought for, the observer being generally satisfied to regard the case as one of the granular kidney. Among the general characters of renal tumours (p. 710) is to be found an outline from a case recorded by Bright. The laterally symmetrical, though often unequal, tumours are softer than solid renal growths, but do not fluctuate.[1] Dr. Hare's case, already referred to, gives an instance of the largest abdominal swelling from this cause, as of the largest renal tumour. The palpable tumefaction reached from the thorax to an inch and a-half below the spine of the ilium, and from the loin to within an inch of the median line. This bulky mass presented in the abdomen in the guise of two tumours on the same side, with bowel between; but since both could be moved together from the loins, it was decided, with the help of Dr. Bright, that there was but one, and that kidney. The kidney on the other side, it may be observed, was not affected so as to be appreciable from without.

Tumour.

The general aspect of the patient, his sallowness, his cardiac hypertrophy and his arterial tension, are, like the urine, all indicative of chronic renal disease, and deceptive as to its nature, unless, indeed, it be held, as may be the case, that the cystic and the granular kidney are varieties of the same essential condition. With the advance of the disease uræmia often presents itself with gastric and cerebral disturbances, obstinate vomiting, convulsion, and coma. This is, indeed, the most frequent cause of death. I noticed in one instance that the body emitted, not the ordinary odour of uræmia, such as is usually produced by disease of the substance of the kidney, but a truly urinous smell, such as more often indicates retention of urine in a cavity, as with obstructive suppression, which, however, did not exist. In an instance I have already alluded to, under my own observation, nearly complete suppression existed for two days before death, after which the lower part of the right ureter was found to be plugged with a decolourised clot, the other ureter and the bladder being natural. Death by uræmia is sometimes anticipated by exhaustion from hæmaturia, and not seldom by bronchitis, pneumonia, or congestion of the lungs, with sudden and severe dyspnœa. This termination occurred in two cases in St. George's Hospital, which have been placed on record by Dr. Whipham.[1] As with the granular kidney, cerebral hæmorrhage has been known to occur in these cases; in a case recorded by Dr. Church there was evidence of an attack of this nature three years before death.[2]

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[1] See case recorded by Roberts, 3rd edit. p. 512.

Uræmia.

Other causes of death.

Duration.

It is difficult to estimate the duration of a disorder of which the beginning is usually so indefinite. It must necessarily be considerable. In a case at St. George's Hospital the outset was apparently due to a blow seven years before death; in another, at the same institution, lumbar pain appeared to mark its beginning five years before death. Dr. Bright's patient, from whom the outlines were taken[3] which have been reproduced, was attacked with hæmaturia two years before death; Dr. Hare's nine months before death.

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[1] *Path. Trans.* vol. xxi. p. 244.

[2] *Ibid.* vol. xix. p. 274.

[3] Bright on *Abdominal Tumours* (Sydenham Society) p. 208.

Treatment.

It is not necessary to refer to treatment further than to say that the uræmic symptoms must be met in the ways detailed in connection with granular degeneration.

Congenital Cystic Transformation of the Kidneys.

Morbid appearances.

Causes.

The kidneys of the fœtus sometimes undergo a cystic transformation similar to that which belongs to extra-uterine life, though it is sufficiently clear from the age at which the later disorder declares itself, that it is not a continuation of a congenital condition, but an acquirement of advancing years. The fœtal condition is of little interest to the physician, however important to the pathologist as showing typically and simply the results of obstruction. The disorder has not come within my experience, and I have nothing to add to what is generally known. The kidneys may have become swollen *in utero* so as to equal or exceed the bulk of the healthy kidney of the adult, by a cystic transformation which closely resembles that which has been already described, and is due to absence or obstruction of the urinary exit. The cysts have been found to contain urinary matters, and there is a concurrence of evidence and probability that they generally consist of dilated and intersected tubes, as those of a later date have been shown to do. Sir W. Gull,[1] who reported many years ago upon a typical example of a congenital change of this nature, inferred that the cysts were dilated Malpighian capsules, but it is not unlikely that with recent methods this excellent observer might have been led to a different result. The cystic transformation of fœtal life is generally associated with absence of the ureter or pelvis, or some malformation which renders the escape of urine impossible. In the case examined by Gull, and reported by Lever, there was a total absence of ureters; and in other instances, other parts of the urinary channels have been occluded or deficient. In certain cases Virchow found closure of the straight tubes a result, as he supposed, of the impaction of uric acid and intra-uterine nephritis. In most cases there has been absence or imperfection of the pelvis, ureters, or other of the larger exits, which has been often associated with malformations in other parts of the body.

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[1] Case reported by Dr. Lever, *Path. Trans.* 1848–49, p. 71.

Consequences.

The absence of renal function in these cases may cause the death and premature expulsion of the fœtus; the abdominal tumour which arises may be such as to be a hindrance to birth, which can only be overcome by operation; or, should this difficulty be overcome, the child may perish shortly afterwards from respiratory embarrassment, due to the encroachment of the abdominal swelling upon the thoracic cavity.

Solitary Renal Cysts.

Of same kind as multiple cysts.

Otherwise healthy kidneys are often found, especially in persons of advancing years, to contain small solitary cysts, which project from the capsule and burst with miniature violence as this is being removed. These are apparently of the same nature as the multiple cysts which have received attention, due to the accidental occlusion of a single tube. Such cysts may occupy either the cortices or cones, may be absolutely single, or be accompanied with one or two others, as if to declare their alliance with the multiple cystic disease, and they may attain a considerable size, so as to come within the category of renal tumours. They usually have a thin wall, scarcely to be separated from the renal tissue, and have been found to contain urinous, albuminous, gelatinous, and bloody fluid, urinary salts and cholesterine. A cyst probably differing only in size from the small and multiple variety is to be seen at the College of Surgeons. It is thin-walled and membranous, of spherical form, and six inches in diameter. This protrudes from the outer surface of a somewhat enlarged kidney, which is granular, and exhibits a few more cysts, apparently of the same sort, but only a line or two in diameter. This cyst must have formed an abdominal tumour of considerable prominence.

A renal cyst of almost the same dimensions and apparently the same kind—it was ovoid in shape and measured $6\frac{3}{4}$ by 6 inches—has been described by Dr. Hare.[1] It lay in front of the right kidney, in the substance of which it had developed, with the undilated pelvis and ureter behind. The walls were from one-fifth to half-an-inch in thickness, the outer parts dense, the inner flocculent and fibrinous. A pale yellowish-green fluid was contained, which was at first limpid but became gelatinous on exposure. Another cyst was found of the size of a hemp-seed; in other respects both kidneys were healthy. The subject was a man sixty-two years of age, who died of phthisis. Two years and three months before death, he had been severely bruised by a horse in the lumbar region. The tumour, partly covered with bowel, occupied during life the greater part of the right half of the abdomen, and extended beyond the umbilicus towards the left. The superficial abdominal veins were swollen, and both lower extremities œdematous, especially the right.

Mr. Morris[2] has described a large renal cyst, which is possibly of a different nature.

Cysts probably of malignant origin.

A man sixty-nine years of age displayed, two and a-half years before death, a tumour to the left of the umbilicus as large as a cricket-ball. It gave no pain, and had not followed any injury. The urine was albuminous, and once or twice contained a little blood, though before death it became natural. The tumour increased until it filled nearly the whole abdominal cavity with a fluctuating swelling which, had the sex been different, might have been supposed to be ovarian. A puncture with a fine trocar succeeded in drawing off only a drop or two of dark bloody fluid. He had several attacks of syncope, generally after exertion or eating, became much emaciated and enfeebled, and so sank. A cyst which weighed sixteen pounds and measured in diameter twenty-nine inches by twenty-six, occupied the belly in the usual situation of a left renal tumour. This was developed in the substance of the kidney, beneath the capsule and apart from the pelvis, which, together with the ureter, was somewhat dilated, though apparently only secondarily. The cyst was filled with brown fluid and blood-clot, the latter disposed in layers upon the wall. The left kidney contained also a transparent cyst of the size of a currant, and several cysts, varying in size from a pin's head to a pea, were found in the right kidney. The left kidney further contained two small nodules of medullary cancer, while small masses of the same nature existed in the liver and lungs. Mr. Morris is of opinion that the cystic formation was independent of the cancerous, and indeed it is clear that the smaller cysts at least were of ordinary, not malignant, type. But it may, perhaps, be taken into question whether the large cavity into which hæmorrhage so profusely occurred as to cause repeated fainting, and which so rapidly attained such huge dimensions, had not become malignant, even if it had not begun so. We know that a malignant growth is often a superaddition; while profuse bleeding into the interior of such a growth of renal origin is a familiar experience.

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[1] *Path. Trans.* vol. iv. p. 199.

[2] *Ibid.* vol. xxii. p. 171.

Paranephric Cysts.

There are some cysts, not always of the same kind, but which may be classed together as neither developed in the kidney tissue nor dilatations of its cavity, though they often open into it, but as involving the organ from the outside. The terms *paranephric*, or *pararenal*, may be applied to these formations as to solid tumours similarly placed. Some of these cysts are congenital, others of later and perhaps doubtful origin. The occasional connection of these cavities with that of the pelvis must make them clinically indistinguishable from hydronephrosis, however distinct in their nature.

May be of intra-uterine or extra-uterine origin.

A preparation at St. George's Hospital displays a renal annex of this kind.

Example from an adult.

A large cyst protruded from the back of the pelvis, which is generally but little dilated, and is scarcely unnatural except that its posterior wall opens into the cyst behind it. The ureter which was unobstructed opened into the cyst, so that this cavity lay in the course of the urine, between the pelvis and its duct.

The cyst resembled in extent, and somewhat in shape, a distended stomach, and held above four pints of clear albuminous fluid.

The abdominal tumour was first noticed when the patient, a woman of the age of thirty-seven, was brought into the hospital in consequence of having been knocked down in the street. She fell down, became unconscious, and died in a few hours from causes which the *post mortem* imperfectly explained. She had emphysema and bronchitis.

Some aqueous cysts present themselves in connection with the kidney, but clearly external in origin as well as position.

One of fœtal origin.

A remarkable preparation of this sort is to be seen at St. George's, and is described by Mr. Cæsar Hawkins in the eighteenth volume of the 'Medico-Chirurgical Transactions.' It had presented itself three months before death as a tumour in the right side of the abdomen of a boy six years of age. The cyst, which held five pints of transparent fluid, ascertained by Dr. Prout to be free from urinary constituents, lay behind the kidney, which was closely attached to its wall, but had no essential connection with it.

There were, however, two small openings in the pelvis, apparently the result of ulceration, which made communication between the renal and the cystic cavities. The ureter had no communication with the cavity of the cyst, but entered the kidney in the usual manner. Attached to the cyst wall was a rudimentary third kidney of the size of a walnut. A prolongation of the cyst passed under Poupart's ligament, and through the femoral ring. The formation was clearly of fœtal origin. I have elsewhere alluded to a case (p. 723) in which the appearance in the scrotum of a portion of a cystic growth of equivocal origin led to a just inference that it had originated not within, but outside, the kidney, the outlying portion having probably been brought down with the descending testicle, the embryonic tissues about which organ in its first situation being, as it seems, rather apt to undergo morbid development.

CHAPTER XI.

RENAL CALCULI IN GENERAL AND PARTICULAR, WITH THEIR CAUSES.

General Considerations relating to their Formation and Distribution.

Many secretions—urine, bile, saliva, and the secretions of the prostate gland and tonsils—are apt to throw down within their channels or reservoirs certain of their elements which are superabundant, or which, from other circumstances, are no longer capable of solution. Of all secretions, the urinary is the most apt to undertake this process. It is highly complex and highly variable. Furnishing, as it does, the main exit by which the blood discharges its superfluities of almost every kind, its several components change in amount with every change of system. According to the nature of the superfluities which it thus receives, the urine continually becomes loaded beyond its capacity of continuous solution with various materials, which are in their way out precipitated in one part or another of the complicated urinary channels. Besides the numerous deposits which thus result from an excess in the urine of their components, there are others which owe their precipitation, not to any superabundance of their material, but to some change in the urine which renders it less than naturally capable of holding it in solution.

The precipitation is most apt to occur in the pelvis of the kidney and in the bladder, in which cavities the urine may remain for a time in considerable bulk and in comparative quiescence. Calculi, especially if they be composed of uric acid, oxalate of lime, or cystine, generally take their first concrete form in the pelvis, though they sometimes escape notice until they have reached the bladder, become the centres of further concretion, and the source of vesical symptoms.

Renal, though generally more simple than vesical, calculi, present a considerable variety of composition. The following concretions have been found in the human kidney, or presumably passed from it:—

Classification of calculi.

Primary deposits	Uric acid.
	The urates of soda and ammonia.
	Oxalate of lime.
	Phosphate of lime.
	Carbonate of lime.
	Cystine or cystic oxide.
	Xanthine or uric oxide.
	Indigo (?)
Secondary deposits	Mixed phosphates (fusible calculus).
	Phosphate of ammonia and magnesia.
	Carbonate of lime.

Those classed as *primary deposits*, or at least the first six of them—for of xanthine and indigo we know but little—are thrown down in the kidney independently of any preceding local change. When renal calculi consist of one ingredient only, they are always composed of one of these substances. When renal calculi consist of more than one material, one of these substances invariably forms the nucleus.

The three secondary deposits occur only in kidneys which have been the seat of previous disease; they are continually deposited upon stones of some other sort, as the result of the pathological changes they have set up. They occur as layers upon the primary calculi, never as independent concretions in healthy kidneys.

In order to give a general idea of the relative frequency and mode of combination of the different kinds of calculous substances—a point of great practical importance—I have compiled the following table, which gives the composition of ninety-one analysed renal calculi belonging to the thirteen pathological museums of London. Considering

Composition of the calculi in the London museums.

from what scattered sources the hospitals of the metropolis attract patients and specimens, it may be held that the collection represents not merely the local tendencies of London, should there be such in relation to this question, but comprises the produce of a wide field of disease, and perhaps portrays not very unfairly the general constitution of English renal stones.

The table has been compiled with much care, the results of personal inspection having been in the case of each of the hospitals corroborated or corrected by the gentleman in charge of the museum.[1]

It may be assumed that the errors of the table are only of omission. There is no reason to doubt in any instance the existence of the calculous substances in the position assigned to them. But, on the other hand, it is by no means unlikely that many of the concretions may have contained matter which escaped observation, so that calculi represented as simple might to a more minute analysis have declared themselves compound. Hence it must be taken that the table rather under- than over-states the complexity of renal stones.

The calculi were in most cases obtained from the body after death, though one or two examples have been included of calculi voided by the urethra immediately after a nephralgic attack.

The table gives the composition of ninety-one renal calculi. Of these fifty-two are simple; thirty-nine compound. Of the compound stones twenty-two are composed of two ingredients; ten of three; seven of four.

Composition of simple calculi.

As regards the simple calculi, uric acid is their most frequent material, forming rather more than a third of the number. Oxalate of lime comes next. Mixed and triple phosphates occur not seldom in the guise of simple calculi, though it is probable that, in some cases at least, a nucleus of a different substance would have come into view had the section fallen more happily.

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[1] I have to acknowledge my obligations to Dr. Green at the Charing Cross Hospital, Dr. Moxon at Guy's, Dr. Kelly at King's College, Mr. McCarthy at the London Hospital, Dr. Cayley at the Middlesex, Dr. Gee at St. Bartholomew's, Dr. Payne at St. Mary's, and Dr. R. J. Lee at the Westminster, all of whom have given me assistance in this matter. To Mr. Carter at University College I am indebted in an especial manner, since he undertook, with a view to this inquiry, the analysis of seven calculi which had not previously been examined.

The list does not comprise any example of the pure phosphate-of-lime calculus, the concretions which are described as phosphate of lime, from the circumstances under which they were found, almost certainly (see note 1, p. 864) consisting of the mixed phosphates. Carbonate of lime occurred in one instance—I believe an unique specimen; cystine in two. Of xanthine there is no example.

Of compound.

As to the compound calculi, it appears that they have almost invariably sprung from a nucleus of oxalate of lime, uric acid, or the urates. Oxalate of lime occurs most often in this relationship, and indeed is the most frequent constituent of compound calculi, existing in about two-thirds of the whole number. The tendency of oxalate-of-lime calculi to become compound may be explained partly by the fact that such stones are, from their roughness and hardness, particularly apt to set up local inflammation and consequent phosphatic deposition, and partly by the consideration that persons who have deposited one lime salt are constitutionally liable to deposit another.

Regarding the presence of the phosphates in these calculi, it is of little practical importance to distinguish the calcic-phosphate from the ammonio-magnesic, or the mixture of the two from either alone. These salts are all the product of alkaline urine, and are apt to occur in succession or jointly. They are all incapable of being diminished, but, on the other hand, are liable to be increased by the use of alkaline solvents.

The same statements apply to carbonate of lime, which is often deposited in association with the phosphates. Of the compound calculi, twenty-four out of the thirty-nine, or about three-fifths, contained either one of the phosphates or carbonate of lime; and thus had grown, as we may certainly infer, in connection with alkaline urine; a

Table showing the Number and Composition of the Renal
have been chemically

	Composition of Stone	Total of each kind
52 of uniform composition.	Uric acid	21
	Mixed urates	3
	Oxalate of lime	11
	Phosphate of lime (?)	3
	Phosphate of ammonia and magnesia	2
	Mixed phosphates	9
	Carbonate of lime	1
	Cystin	2
22 of two materials.	(*Uric acid + urates*)	7
	Uric acid + oxalate of lime	1
	(*Uric acid + oxalate of lime*)	3
	Uric acid + mixed phosphates	1
	(*Oxalate of lime + urates*)	2
	Oxalate of lime + phosphate of lime	1
	(*Oxalate of lime + phosphate of lime*)	1
	Oxalate of lime + mixed phosphates	2
	(*Oxalate of lime + carbonate of lime*)	1
	(*Phosphate of lime + mixed phosphates*)	2
	Mixed phosphates + phosphate of ammonia and magnesia	1
10 of three materials.	(*Uric acid + urates + oxalate of lime*)	1
	Urates + oxalate + uric acid	1
	Urates + (*phosphate of lime + urates + oxalate of lime*)	1
	(*Oxalate of lime + urates*) + phosphates	1
	(*Oxalate of lime + phosphate of lime + phosphate of ammonia and magnesia*)	2
	(*Oxalate of lime + phosphate of lime*) + carbonate of lime	1
	(*Oxalate of lime + carbonate of lime + uric acid*)	1
	Phosphate of lime + carbonate of lime + urates	2
7 of four materials.	Uric acid + (*urate of lime + urates + phosphates*)	1
	(*Uric acid + urates + phosphates + oxalate of lime*)	1
	Urates + oxalate of lime + (*mixed phosphates + carbonate of lime*)	1
	Urates + uric acid + (*oxalate of lime + phosphate of lime*)	1
	(*Urates + uric acid + oxalate of lime*) + mixed phosphates	1
	Oxalate of lime + (*phosphate of lime + urates + phosphate of ammonia and magnesia*)	1
	(*Phosphate of lime + phosphate of ammonia and magnesia + carbonate of lime*) + oxalate	1
		91

Where not expressed to the contrary, the components of the calculus are placed in their order of position, proceeding from the centre to the circumference.

Components which are printed in italics and bracketed are either not regularly superimposed, or are insufficiently described as to their relative position.

Calculi in both kidneys, or several calculi in one kidney, if of the same kind count only as one.

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[1] The two specimens described as phosphate of lime, in Guy's Museum, were taken from otherwise diseased kidneys, and may be looked upon as certainly of the mixed phosphates.

Calculi in the Pathological Museums of London, which examined. (*March* 1871.)

Number in each Museum												
College of Physicians	College of Surgeons	Charing Cross Hospital	Guy's Hospital	King's College Hospital	The London Hospital	The Middlesex Hospital	St. Bartholomew's Hospital	St. George's Hospital	St. Mary's Hospital	St. Thomas's Hospital	University College Hospital	The Westminster Hospital
—	10	2	—	1	3	—	—	1	2	—	1	1
—	1	—	—	—	2	—	—	—	—	—	—	—
—	2	—	3	—	—	1	2	2	1	—	—	—
—	—	—	2[1]	—	—	—	1[1]	—	—	—	—	—
1	—	—	—	—	—	—	1[2]	—	—	—	—	—
—	2	—	2	—	—	2	—	3[3]	—	—	—	—
—	—	—	—	—	—	—	—	—	—	1	—	—
—	—	—	—	—	—	—	1[4]	—	—	1	—	—
—	2	—	—	—	1	—	1	—	—	—	3[5]	—
—	—	—	—	—	—	1	—	—	—	—	—	—
—	—	—	1	—	—	—	1	1	—	—	—	—
—	1	—	—	—	—	—	—	—	—	—	—	—
—	1	—	—	—	—	—	—	—	—	—	1	—
—	1	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	1	—	—	—	—
—	1	—	1	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	1	—
—	—	—	—	—	—	—	1	1	—	—	—	—
—	—	—	—	—	—	—	1	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	1	—
—	1	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	1	—	—	—	—
—	1	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	2	—	—	—	—
—	—	—	—	—	—	—	—	1	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	1	—
—	—	—	—	—	—	—	2	—	—	—	—	—
—	1	—	—	—	—	—	—	—	—	—	—	—
—	—	—	1	—	—	—	—	—	—	—	—	—
—	1	—	—	—	—	—	—	—	—	—	—	—
—	1	—	—	—	—	—	—	—	—	—	—	—
—	1	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	1	—	—	—	—
—	1	1	—	—	—	—	—	—	—	—	—	—
1	28	2	10	1	6	4	11	14	3	2	8	1

That in St. Bartholomew's is described as mixed with much animal matter, and similarly must probably be regarded as of mixed phosphates. There is, therefore, no renal calculus of pure phosphate of lime included in the table.

[2] There was another calculus in the same kidney, which consisted externally of the mixed phosphates. It was not examined internally.

[3] One of these specimens was obtained from a man who had previously got rid of, by operation and natural expulsion, both uric acid and oxalate-of-lime calculi.

[4] This calculus was dusted over with plates of cholesterine.

[5] In two of these specimens the urates only amounted to a trace.

Abstract of Table showing frequency with which each Substance occurred in Simple and Compound Calculi.

91 calculi: 52 simple; 39 compound.

Uric acid occurred in	40 calculi,	21 simple,	19 compound
Urates	24 ,,	3 ,,	21 ,,
Oxalate of lime	36 ,,	11 ,,	25 ,,
Phosphate of lime	16 (?) ,,	3 (?) ,,	13 ,,
Phosphate of ammonia and magnesia	7 ,,	2 ,,	5 ,,
Mixed phosphates	20 ,,	9 ,,	11 ,,
Carbonate of lime	8 ,,	1 ,,	7 ,,
Cystine	2 ,,	2 ,,	0 ,,

Frequency of uric acid in renal calculi as compared with other ingredients.

fact, the importance of which will appear in relation to the action of solvents. Of the whole number of calculi, simple and compound, included in the table it is worth observing that thirty-one were wholly composed of uric acid and urates, while there were forty calculi in which uric acid appeared either alone or with other matters. Uric acid therefore was not present in half the number; and did not compose wholly, or with the sole assistance of the urates, above a third. The proportions do not bear out a statement sometimes made, that three-fourths, or even five-sixths, of all renal calculi are composed of uric acid; it is probable, however, that uric acid would be found in greater proportion in the smaller stones of routine practice than in these museum specimens, which especially represent advanced disease, and, of necessity, phosphatic deposits.[1]

Of the ninety-one renal stones fifty-eight contained oxalate of lime, one of the phosphates, or carbonate of lime. The carbonate of lime and the phosphates forming usually the superficial layer, would not only have prevented the entire solution of the stone, but would have prohibited any commencement of the solvent process.

Vandyke Carter on calculi of India.

Since these observations were made, Dr. Vandyke Carter has brought forward some important evidence with regard to the components of the calculi of India.[2]

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[1] Dr Bence Jones stated that 75 per cent. of all renal calculi are uric acid; Dr. Roberts, that five-sixths are thus composed.

[2] *On the Structure and Formation of Urinary Calculi.* London, 1873.

'Of sixty-two *vesical* calculi,' says this observer, 'the nucleus was composed of urates mixed with crystals of oxalate thirty-four times; of oxalate chiefly twenty-one times; of uric acid chiefly seven times.' Thus, of sixty-two calculi the nucleus of fifty-four consisted wholly or in part of this salt of lime. Speaking of its presence in *vesical* calculi generally, either centrally or otherwise, it was found to be their most frequent component, occurring in no less than seventy per cent. of those examined. Urates which came next in frequency were found in sixty-two per cent.; uric acid in thirty-six per cent. These observations relate only to India, where possibly uric acid may be less common, and oxalate of lime more so, than in England; but it is probable that under all circumstances oxalate of lime, with its remarkable tendency to crystalline aggregation, more often lays the first stone of calculus, though as an urinary deposit it is far less common than the urates and uric acid.

General structure of calculi.

There are several points in relation to the origin of urinary calculi, which, since they are common to many kinds, may be referred to before entering upon the separate consideration of each. These stones are often highly complex in their nature, consisting of many ingredients, and these arranged in an elaborate manner. Dr. Vandyke Carter[1] has shown that their structure is largely crystalline, and that the crystals present much variety of form and arrangement, sometimes giving rise to patterns which simulate agates or some other production of the mineral kingdom. In the next place, there is a constant intermixture, and sometimes the existence, as a nucleus, of animal matter. Particles of blood-clot have long ago been referred to as forming the centres of urinary stones, and Bilharzia have since been found in the same position. Dr. Vandyke Carter states that in his examination of the calculi of India, an organic basis was generally to be detected after the removal by solvents of the stony matter. This was distinctly to be seen, whether as a basis or a subordinate formation in calculi of uric acid, urates, or the

Their interstitial organic matter.

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[1] *Loc. cit.*

oxalate. It is described as a translucent, generally structureless, substance, interfused through the stone; it is not to be supposed that it is other than a secondary product. The crystallisation occurs in an organic fluid, and organic matter must needs be involved.

The varying consistence of the urine in which the calculi are engendered, and the various intermixture with them, particularly with the phosphatic kinds, of mucus and other morbid secretions, have, as Dr. Ord has shown, a large influence upon the mode and character of the crystallisation.

Ord's views upon the influence of viscidity.

The influence of viscidity in the mother liquor in the determination of globular forms, as of carbonate of lime, is not to be disputed, and it must be allowed that crystals of the oxalate are occasionally to be found in a web of mucus or fibrine, like fish in a net; but it is not clear whether the crystals have collected the web or the web the crystals; and perhaps we should hardly be justified in assigning to tenacious admixtures so large a part in the begetting of calculi as Dr. Ord is disposed to do.[1]

I think it is to be asserted with general truth that, putting aside the phosphates and carbonates, calculi are formed more often in obedience to systemic states and consequent variations in the normal constituents of the urine than from local disease or 'colloid' admixture. Stones are not especially common with albuminuria and diabetes where colloids and viscidity abound. On the other hand, we have sufficient evidence that they abound much in proportion to the abundance of their material in the urine and the degree of concentration of that secretion. Thus calculi are common as in Norfolk, where the drinking water is hard and the excretion of lime necessarily superabundant; they occur especially in persons whose habits or predispositions tend to the making of uric acid; and it is a matter of unwritten as well as of recorded experience that calculous disorders are frequent in India, where the renal secretion is drained of water by that of the skin.

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[1] I am enabled, by Dr. Ord's courtesy, to subjoin an abstract of his views in his own words:—1. In experiments I have never found oxalates, or uric acid, or urates, form calculous masses unless in the presence of colloids. Uric acid, indeed, sometimes forms *layers* of matted crystals on the sides of vessels. 2. In the presence of colloids either cohesion or metamorphosis to spherical form always occurs; not always both. 3. Hundreds of people pass uric acid and oxalate in abundance without getting calculus. 4. The same may be said of people having albuminuria and inflammation of the urinary passages. 5. I have never examined any calculus which, in addition to its crystalline substance, had not also a colloid matrix. 6. I believe that it is most probable that no calculus is formed of oxalates, urates, and uric acid, or phosphates, without the intervention of a colloid. This may be albumen in solution, exudation in renal tubes, mucus or exudations in renal passages, ureters, or bladder. The most active element in forming calculi I believe to be the exudative matter of the tubes and mucus from the tracts. With albumen, spherical forms are produced, but there is less tendency to aggregation. In this I believe the viscidity of the mucus acts by holding the crystals once formed in such a position as to invite accretion.

Geographical distribution of urinary calculi.

The geographical distribution of urinary calculus throws great light upon its causation. The prevalence of this disorder in the eastern counties, especially in Norfolk, has long been a matter of notoriety. It has recently been numerically displayed by Mr. Cadge, of Norwich, to whose valuable paper I must refer for particulars. He has deduced from the reports of the Registrar-General that deaths from stone are more frequent in proportion to the population in Scotland than in England and Wales, and in England and Wales than in Ireland. In England the greatest proportionate mortality from this cause is in the eastern district, the smallest in the districts described respectively as the north-western and south-western. Arranging the counties of England according to the mortality from this cause, Norfolk, Huntingdon, Kent, and Sussex head the list, Cumberland, Cornwall, and Cheshire conclude it. This mortality in Norfolk is about ten times that in Cheshire; in Norfolk 1 in 42,744 of the population; in Cheshire 1 in 425,520.[1] From the experience of hospitals all over Great Britain Mr. Cadge has drawn a similar conclusion. In the Norfolk and Norwich Hospital the stone cases bear to the total number of in-patients in one year a proportion of 1 to 55; in the Devon and Exeter Hospital a proportion of 1 to 1,298. It is possible that cases of one sort may be attracted to a local hospital by its reputation in connection with their treatment; but this reputation may have been due to the practice afforded by the prevalence of such cases in the neighbourhood, and be only another testimony to its morbid proclivities; while it may be further said that patients of the hospital class are not prone to select distant institutions when nearer are available. The practical conclusion from Mr. Cadge's extensive inquiry is a confirmation of the old belief that stone prevails where the water is hard, or in other words, contains a superabundance of lime. That this association exists is proved abundantly. In Norfolk, Huntingdonshire, Kent, and Sussex the water is almost invariably hard; in the western counties it is generally soft. Stone appears to flourish upon chalk and limestone, to be but sparsely produced on sandstone and granite.

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[1] 'Address in Surgery,' by W. Cadge, *Brit. Med. Journ.* Aug. 15, 1874, p. 207.

Their relation to hard water.

The prevalence of stone in Norfolk and the eastern counties has been otherwise attributed to the coldness of the climate, the Teutonic origin of the inhabitants, and the use of Norfolk dumplings. Cold does not appear to be productive of calculus, but rather the reverse. Mr. Cadge informs us that a smaller proportion of stone cases come from the coast of Norfolk, where the cold is greatest, than from the inland villages. Parts of the eastern coast, such as Durham, the East Riding of Yorkshire, and Aberdeen, which are probably colder than Norfolk, present the disorder with less frequency. At the Norfolk and Norwich Hospital 1 case in 55 is of stone; at the Infirmary of Aberdeen 1 case in 184. Beyond these facts Mr. Cadge has pointed out, and our knowledge derived from other sources confirms his statement, that urinary stone is rare in Sweden, Norway, and some other cold countries, common in India and some parts of China. From cases I have seen I should conclude that stone is common in the West Indies as well as in the East, and it

Stone not produced by cold,

but by heat.

must be accepted as a general truth that it belongs rather to the warmer than the colder zones. It could not indeed well be otherwise; the concentration of the urine must needs assist its crystallisation.

Race of little significance, but food of much.

Race probably occupies only a secondary place in giving rise to calculous disorders. In India both Europeans and natives suffer; and if in Great Britain Teutons are more often affected than Celts, it is possible that other differences besides those of race intervene. The east of England, which is most strongly Saxon, is especially the district of cereals and beer; the beer district is generally more prolific in stone than where the local beverage is cider or whiskey. The question of diet in relation to uric acid will be further considered, but I may refer in passing to the discredit which since Prout's time has attached to Norfolk dumplings as a cause of stone. The large local experience of Mr. Cadge is against the view that these dumplings, which consist of flour, water, and yeast, are indigestible or unwholesome, and we have evidence that at least other causes overrule this one; stone is common in Kent and Sussex, where the water is hard but the dumpling unknown.

The comparative infrequency of stone in Ireland is of interest, more especially as the water in many parts of this country is recorded as hard. The use of whiskey instead of beer may help to explain the absence at least of lithatic deposits, while some of the immunity may, perhaps, be attributed to the potato, notwithstanding the views which have been propounded, on somewhat theoretical grounds, to the effect that such vegetable food promotes, instead of preventing, calculous deposition. The rarity of stone in Ireland may indeed be taken as an argument in favour of this article of diet, rich as it is in alkali, and poor in nitrogen, in many cases in which it has been the custom to prohibit it.

Another dietetic point turns upon the general infrequency of stone among the children of the rich, its commonness among those of the poor. Operating surgeons concur in bearing witness to this disparity, which has been made prominent by my colleague at the Hospital for Sick Children, Mr. T. Smith.[1] He assigns the frequency with which the children of the poor suffer to arrested cutaneous action from dirt, and to unsuitable food. Mr. Cadge, probably with more exactness, attributes it to the absence of milk from their dietary. It is obvious that where milk is largely replaced by bread or other solid food, the urine may fail to be supplied with water in proportion to its solid constituents.

Explanation of the over-ruling effect of hard water in the causation of stone.

Putting aside hereditary and other causes proper to the individual, the over-ruling influence which appears most strongly marked in the causation of stone is calcareous impregnation of the water. It would be hard to explain this but for such evidence as has been already adduced with regard to the frequency of oxalate of lime as the nucleus of stone, although it may be that the later deposit is of a different kind. Mr. Cadge represents the stones of Norfolk as almost always consisting of the salts of uric acid, and deals with their production as a simple question of lithuria. But it is not easy to show how hard water should determine this deposit. If they are especially diuretic, as they are said to be, they should, beyond other waters, prevent the deposition at least of the salts of uric acid. If the stones thus begotten of water are begun with the oxalate, their origin ceases to be a mystery. And Norfolk stones must be very different from stones elsewhere, if this is not more often the case than superficially appears. I have often administered lime experimentally, as lime water, the saccharated solution of lime, chalk mixture, and a solution of the acetate; urinary deposits result abundantly, not as uric acid or urates, but as oxalate and phosphate of lime. Crystals of the oxalate constantly appear from such medicaments, often of striking size and abundance. Whether oxalic acid is a normal constituent of urine I will not discuss, but it is at least clear that the oxalate of lime appears in a large majority of persons after the ingestion of the earth. This fact cannot but throw light upon the connection of calculi and hard water.

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[1] *Brit. Med. Journ.* 1869, vol. 1, p. 442.

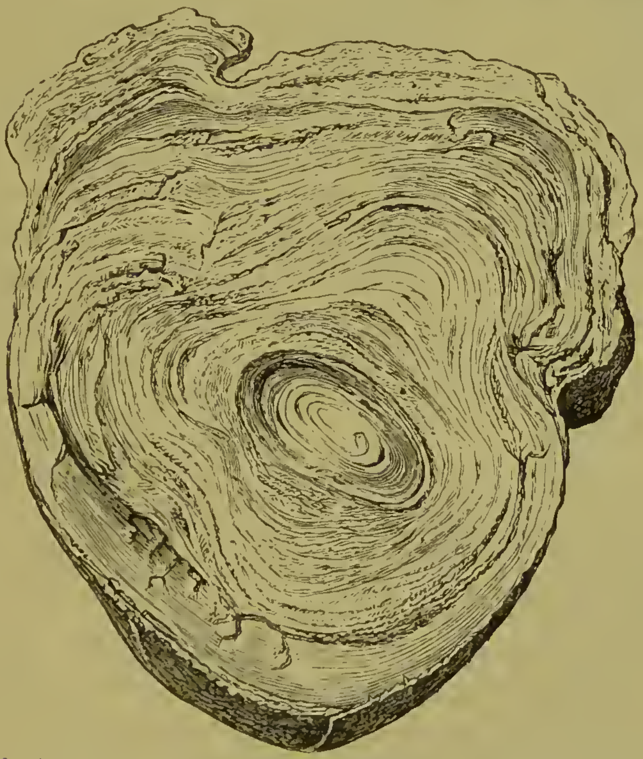
Calculi being different from each other in physical and chemical properties, arising from widely different causes, and requiring diverse and even opposite treatment, each must receive individual consideration.

Uric Acid and the Uric Acid Diathesis.

Its frequency in calculi.

Uric acid is the most common constituent of renal calculi. The estimates of Bence Jones and Roberts have been stated.

Sir H. Thompson, speaking not especially of renal calculi but of calculi of constitutional as distinguished from local origin, says 'nineteen out of twenty of such stones have uric acid for their basis, the remaining one in twenty being oxalate of lime.'[1] But I cannot doubt, from the evidence already brought forward, that



Renal calculus which weighed seven and a-half ounces. Nucleus urate of ammonia; remainder uric acid, nearly pure; oxalate and phosphate of lime on the exterior. (From illustrated catalogue, College of Surgeons.)

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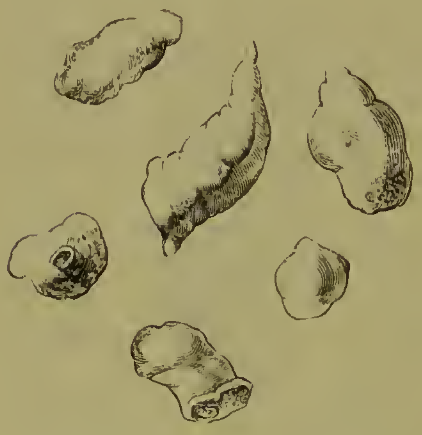
[1] 'Clinical Lectures on the Early History of Calculous Disease,' *Lancet* Jan. 13, 1872.

the frequency of uric acid in renal concretions is less than these observers represent. From my facts it would appear that of simple calculi from the kidney, about one-half are composed of uric acid or urates; while of compound calculi more than half contain neither of these substances. These facts are of importance as bearing upon the medical treatment of these deposits.

Description of uric acid stones;

Uric acid stones generally have a yellowish, yellowish-red, or gravel colour. They are harder and less brittle than the mixed or triple phosphates, but not nearly so hard as oxalate of lime. They are usually smooth externally, arranged in concentric layers by a process of even stratification; contrasted in this respect with oxalate of lime calculi, which are spiked, as if disposed not upon the circumference, but the radii of a circle.

Uric acid deposits occur in the pelvis of the kidney in sizes which vary from the minutest grains to the weight of nearly half a pound. The preceding woodcut (page 873) represents a renal calculus at the College of Surgeons, which consists of uric acid deposited upon a nucleus of urate of ammonia, and weighed 7½ ounces. This appears to be the maximum. Uric acid calculi of large size are not so frequent in the kidney as are large phosphatic stones. Uric acid more often forms concretions of comparatively moderate size, such as are represented on this and the next page.


Several small uric acid calculi from the kidney. (From specimens at the College of Surgeons.)

often bilaterally symmeterical;

They are often symmetrically disposed in both kidneys, dangerously obstructing the escape of urine. They frequently have a shape suggestive of a shark's tooth or antique arrow-head (see also woodcut on next page), the point being moulded in the infundibulum, the widened base lying in the pelvis, their soft structure being worn by friction so as to form plugs which fit with fatal accuracy. The position of such calculi is shown at pages 954 and 957.

often pisiform.

A common form of the uric acid concretion is that described by Dr. Prout as pisiform.[1] Numerous and minute concretions, which have been likened to hemp-seed or peas, often collect in the pelvis, and are discharged with the urine, sometimes in great numbers. A gentleman, under the care of Mr. Nunn, during the space of two months passed with the urine above 300 such calculi, which evidently had but recently left the kidney.

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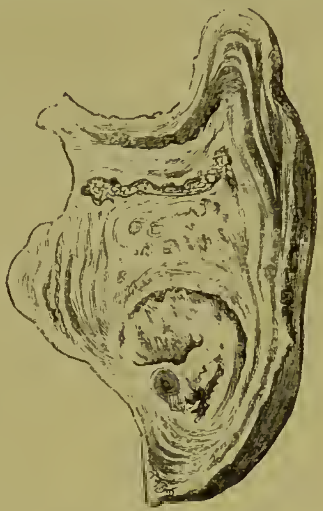
[1] *Path. Trans.* vol. xvi. p. 181.

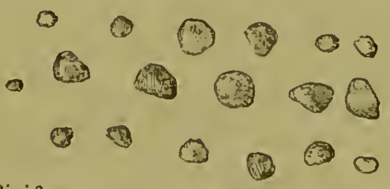
Uric acid calculi appear generally to originate in the kidney, often while small traversing the ureter, painlessly or otherwise, to become in the bladder the centres of concretion, or thence to be happily expelled. Under less fortunate circumstances the calculi remain in the kidney, and there grow until they are too large to make their escape. Whatever be their destination, the kidney appears to be their usual birthplace; the pelvis, except in infancy, more often than the tubes. It is known that uric acid and urates are apt to concrete in the straight tubes during the first ten days of extra-uterine life, during which period the flow of urine is often scanty and irregular.[1] The crystalline and amorphous masses thus produced may reach the pelvis in a concrete form, and there lurk in quiet to become the seats of further deposition.



Place of the concretion.

Uric acid calculus from the kidney. The shape is characteristic. (From a specimen at the College of Surgeons.)

The tubal origin of uric acid calculi appears, however, to be rare save in infancy. Crystals of uric acid are seldom found in the tubes after the secretion of urine has been fairly established.



Pisiform uric acid calculi, passed by the urethra. (St. George's Hospital.)

In its rapid movement and small volume, the urine in the tubes is not advantageously circumstanced for crystallisation. Under ordinary circumstances it reaches the pelvis loaded with all its redundancies. During sleep, when the stream in the ureters is not assisted by gravity, and to a less extent in sedentary postures, whereby those exits are compressed by unshifted and constrained abdominal viscera, the urine is apt to collect, remain quiescent and deposit. The process is analogous to what takes place on a larger scale when torrents throw down mud on entering a lake. According to Prout the uric acid is first precipitated as a gelatinous or amorphous hydrate, which afterwards gathers into crystals. This process may be accompanied or followed by a dull pain or sense of weight in the lumbar region, which may shortly pass away or may give place to more marked signs of renal concretion. What is known as to the chemistry of uric acid in the body may be shortly stated, and is enough to be of some value, though much still remains to be learned. Uric acid as an excrementitious substance of the nitrogenous class supplies a form of exit for a certain proportion of the nitrogenous waste. It is derived in part from food, and in part from tissue; the proportion which each supplies probably admitting of much variation. Food plays an important part in the process. With healthy organs and sound digestion, the more nitrogenous the diet the more uric acid is discharged. The following table given by Dr. Harley[1] illustrates this fact, and many more statements of the same kind might be adduced. With wholly nitrogenous food uric acid is at its maximum, with non-nitrogenous food at its minimum.

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[1] See p. 881.

Nature and origin of uric acid.

Its relations to food,

Quantity of uric acid passed during twenty-four hours by healthy adults.

	Lehmann	Harley
	Grammes	Grammes
Animal . . .	1·478	1·250
Mixed	1·183	0·755
Vegetable . . .	1·021	0·500
Non-nitrogenous . .	0·735	0·340

When uric acid out of the body is subjected to an oxidizing agent in the presence of water it is converted into urea, and it has been inferred that a similar action is continually taking place in the body, that uric acid in fact is only an intermediate step between albumen and urea. Whether the relation between these excrementitious substances is thus simple is a matter as yet *sub judice.* Urea is believed to be largely formed in the liver. It is found in the blood which leaves this organ in much larger proportion than in the blood which enters it. In congestive and other morbid conditions of the liver uric acid, with purpurates, is found in excess in the urine, and it may easily be supposed that in the embarrassment which such disease implies the process of transformation may be arrested, so that uric acid is dis-

and to oxidation.

Its organic source.

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[1] *The Urine and its Derangements*, p. 65 (Dr. Harley).

charged in the place of the more elaborated product. There is another fact, however, which, first noticed by Dr. Parkes[1] and since observed by others, is less easily explicable on the theory that uric acid and urea are only steps in the same process. In leucocythæmic enlargement of the spleen the uric acid of the urine is greatly increased, whereas this organ is not known to have any special duty with regard to the making of urea; from this it would seem that uric acid and urea take their origin in different organs and are independent of each other. Leaving the relation between urea and uric acid as undetermined, it is enough for the present purpose to regard uric acid as the less oxidised product of nitrogenous waste. For the diminution of uric acid, therefore, chemistry would indicate the introduction of more oxygen and less nitrogen, more air and less meat, practical rules in the promulgating of which modern science has been anticipated by ancient experience.

On the causes of the morbid deposition of uric acid.

Uric acid may be in excess without being deposited, or it may be deposited when not in excess. Its deposition depends partly upon the acidity of the urine, and partly upon its dilution. Alkaline urine holds it in solution. The presence of a free acid by which the urates are decomposed, determines its precipitation the more readily the greater its quantity and the more concentrated the urine. Another circumstance is accessory, the contact of an inanimate surface, which unprotected by alkaline secretion invites crystallisation.

So far no doubt presents itself, but the whole story is not told. Clinical observation makes it sufficiently evident that the whole mystery of uric acid is not yet revealed. Overmuch nitrogenous food, too little air and exercise, whatever causes hepatic congestion, whether by way of diet, mechanical obstruction, or ague, may be within our understanding as causes of uric acid excess. Gout is likewise associated with it, though the mode of the association is less clear than its existence.

Causes of its excess occasionally obscure.

I have known uric acid gravel to be passed largely and regularly by pale, thin, and impoverished old women, whose diet has assuredly comprised no excess of flesh or luxurious food. With these the deposit occurs in connection with dyspepsia associated with a coarse and poor diet, or with organic changes as yet imperfectly understood.

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[1] Parkes, 'Lectures on the diminution of nitrogen from the human body.' *Lancet*, April 8, 1871, p. 469.

Effect of food in the uric acid diathesis.

Vegetable food since Prout and Bence Jones has been supposed to be a frequent source of 'acidity.' Prout insists on the malassimilation of dumplings and such admixtures of flour and fat, and their effect in producing uric deposits, while Bence Jones dwells upon the amount and variety of acid theoretically liable to be produced in the course of the conversion of sugar and starch into carbonic acid and water. But we do not know how far this acid transmutation actually occurs in the body, though possible out of it.

We know as a matter of observation that under animal diet the urine becomes more acid, under vegetable diet less acid or alkaline. With regard to uric acid in particular, we have the ascertained increased excretion of this acid upon animal diet, and its diminution upon vegetable, and to the same purpose the infrequency of stone upon the potato diet of Ireland.

But whatever be the relation of vegetable food to uric acid it is at least clear that an excess of this substance may occur under two distinct and even opposite conditions, the one caused by overmuch food in relation to exercise, the other occurring without any such excess, to be described somewhat vaguely as the product of mal-assimilation, or perhaps more correctly as the result of organic conditions at present unknown, or known but imperfectly. The influence of hepatic and splenic changes in the production of uric acid has already been adverted to.

Circumstances and causes of the deposition of uric acid.

Deposition of uric acid is more common towards the ends than in the middle of life—more common before ten and after forty than in the intervening period. In infancy and childhood this tendency sometimes is, as Dr. Prout has observed, obviously hereditary, derived from gouty or dyspeptic parents. Among the causes of this deposition in early life nephritis, whether from cold or scarlatina, deserves a prominent place. During convalescence from this disease it is not uncommon to find a remarkable abundance of uric acid crystals in the urine. As the renal channels reopen after their temporary closure, the accumulated excrementitious matters hurry out in superabundance, more uric acid escapes from the kidney than can be retained in solution, and crystals are passed, often in great abundance, with the urine. It may happen that some remain behind, to become the centres of concretion. I have known cases in which the symptoms of renal calculus have dated from, and probably thus originated in, an attack of scarlatinal nephritis.

Among the pathological associates of uric acid diabetes must be mentioned; the deposit is often noticed in the earlier stages of the disease, while as yet the urine is not very copious; the concurrence may possibly be attributed not so much to greater or less oxidation—a theoretical cause to which both sugar and excess of uric acid in the urine have been attributed—but more probably to the definite congestion of the liver, which is associated, as I have elsewhere shown, with diabetes.

During the vigour of early middle life uric acid deposits are comparatively rare. They reappear when the habits of life begin to produce their results and the changes of age to commence. Intimately connected as uric acid is with gout, it may be said that after middle life the causes of gout are the causes of the uric acid diathesis. Both are engendered by bodily inactivity, and occur in those who have lived not wisely but too well.

Treatment of the uric acid diathesis.

As to the treatment of the uric acid diathesis, or, in other words, the prevention of uric acid calculi, we may be wise in our present state of knowledge to be mainly guided by the results of clinical observation. Experience is not in favour of a general recourse to an exclusively or mainly animal diet, though, according to Bence Jones, the fare in extreme cases of the uric acid diathesis should assimilate to that of diabetes—little more than lean meat and brandy and water. It appears to be generally wise to cut off saccharine and oleaginous matters and indigestible forms of pastry, though I believe harm has been done in this condition by the too general avoidance of vegetable food. Malt liquor must be entirely interdicted. It has been observed that as productive of uric acid the presence of acetic acid in any liquor is more injurious than that of malic, tartaric, or citric acid; hence beer does more harm in this respect than wine or cider. All rich and imperfectly fermented wines, port, rich sherry, burgundy, and champagne must be avoided, and the patient restricted to claret or weak spirit and water. Excess of uric acid is often cured by poverty, with its attendant advantages of frugal fare, abstinence, and exercise.

Diet.

> Spare diet and spring water clear
> Physicians hold are good,

especially for those who make uric acid superabundantly. Of this prescription the water plays no unimportant part. It is impossible to exaggerate the use of diluents, of which none can be better than pure water, in the treatment of urinary concretions, particularly when they are of this kind. Water is an universal solvent: it furnishes the natural vehicle for the removal of all the urinary excreta: it is a diuretic of rare virtue, for it is free from irritating properties, while it has the power, rarely possessed by medicines of the diuretic class, of increasing the solids of the urine. And beside its effect in purifying the blood by increased urinary elimination, it will by its solvent action prevent precipitation so effectually that it may be generally stated that the tendency to the crystallisation of uric acid will diminish precisely in the same proportion as the urine is diluted.

Water.

Enough has been said of air and exercise to show their paramount, almost specific, importance.

Medicine.

However the liver may be concerned in the production of uric acid or in the action of mercury, there is no doubt that occasional doses of calomel and of some salient aperient, as sulphate of magnesia or some purging mineral water, as Pullna or Friedrichshall, are often beneficial.

Alkaline remedies, the bicarbonate, or, what comes to the same thing, the citrate of potash, or, less effectively, lithia in similar combination, may be trusted as a means of preventing the precipitation of uric acid, though they do not lessen its production.

For habitual use the effervescing potash water, containing from ten to twenty grains of the bicarbonate to the bottle, is convenient and agreeable. Vichy water answers much the same purpose: it often proves of great service in preventing the deposition of uric acid; as containing soda, however, it is probably less efficacious, and is in some respects more objectionable than solutions of potash. The water of Contrexeville[1] has been vaunted in disorders of the uric acid kind; it seems to have a marked diuretic action, and it is supposed thus to expel gravel and small calculi which otherwise might have grown in peace; it, however, contains a large quantity of lime, which must be a source of danger where the formation of the oxalate or phosphate is to be apprehended.

In connection with the effect attributed to these waters, abounding as they do with lime,[2] Prout noticed that hard waters, though generally to be avoided in calculous disease, sometimes brought away large quantities of gravel by their diuretic action. Similar results occasionally follow terebinthinate remedies.[1] Dr. Henry related the case of a middle-aged lady who, when led by customary symptoms to expect a fit of gravel, was in the habit of taking a mixture chiefly consisting of turpentine and laudanum. This uniformly produced a discharge of uric acid gravel sometimes amounting to more than four ounces in two or three days. Possibly some of this deposit may have been formed as discharged under the constitutional influence which the patient had learned to recognise, assisted possibly by the opium; but the bulk probably was merely dislodged by the diuretic. It has happened to me more than once to find on post-mortem examination so large a collection of uric acid gravel in the pelvis of the kidney that it was difficult to understand how it could have thus accumulated. Possibly in the case alluded to by Dr. Henry some such lodgment had taken place. Small discharges of uric acid gravel under the influence of turpentine are, however, by no means uncommon.

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[1] *Analyses of Contrexeville Water.*

[2] *On Stomach and Renal Diseases*, 4th edit. p. 220.

MIXED URATES.

These require but a brief notice. Uric acid in combination with potash, soda, ammonia, and occasionally lime in varying proportions, the potash generally being in larger quantity than the soda and ammonia, forms the best known of all urinary deposits, marked as it is by the obvious character of ready solubility with warmth. Under certain circumstances this forms or contributes to form renal calculi.

Rare in simple calculi.

Renal calculi consisting only of the urates are exceedingly rare—the museums of London contain but two specimens. They are always of small size, and are, as far as I am aware, peculiar to children. The College of Surgeons has a specimen which was taken from the body of an infant only four months old. Such calculi are light or yellowish in colour, and in texture soft and friable. Their peculiar characteristic is their solubility in boiling water. It is probable that they originate in the deposition of urates in the kidney-tubes. Lines of amorphous lithates mixed with crystals of uric acid are continually found in the straight tubes of children who die soon after birth. It is stated that the deposition is very rarely found in still-born children, or in those

Origin of urates in kidney-tubes.

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[1] *Med.-Chir. Trans.* x. p. 136.

who have breathed for less than twenty-four hours, but that it is generally present between the first and tenth days of extra-uterine life. It is probable, as suggested by Virchow, that this phenomenon depends upon increased production of uric acid by the tissue-change consequent on the establishment of respiration, while there is no proportionate excretion of water to hold it in solution. In cases in which the tubes are thus charged, red sand is often found in the pelvis and bladder, which may easily furnish the seed of a calculus and explain the frequency of stone in childhood. In later life it happens, though comparatively rarely, that lines of urates are found in the cones: possibly this may sometimes be a post-mortem occurrence due to cooling of the body, and consequent precipitation of urates.[1]

Frequency of urates in mixed stones.

As one of the components of compound renal calculi the urates are not uncommon. In thirty-one compound calculi in the museums of London the urates are described as occurring sixteen times. In one instance the ordinary urates were associated with urate of lime. Dr. Vandyke Carter found the urates to be present in some form in sixty-two per cent. of the *vesical* calculi of India, forming the nucleus in fifty-six per cent.: as a deposit he found them commonly to precede, but rarely to follow oxalate of lime; sometimes to precede uric acid, very seldom succeeding to it. Thus the urates are present in half the renal stones, in more than half the vesical.

The urates occur under similar circumstances to uric acid, and may be considered as having the same practical bearing.

XANTHINE, $C_5H_4N_4O_2$.

Relation to uric acid.

Xanthine[2]—xanthic, or uric, oxide—resembles uric acid in composition, from which it differs only in containing one atom less oxygen. It is believed to be a normal constituent of the urine, though existing in it in very small amount.[3]

Xanthine has been found in many parts of the body, including the liver, spleen, pancreas, brain, and muscular tissue. It has been found in the intestinal concretions of animals, and in guano.

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[1] See a paper on 'Uric acid infarction of the kidney,' by Dr. H. Raphael of New York, reported in the *Brit. Med. Journ.* Dec. 10, 1870, p. 634.

[2] Ξανθός, yellow, from the lemon-coloured residue after solution in nitric acid and evaporation.

[3] Dr. Thudichum has given elaborate directions for the obtaining of xanthin from healthy human urine. *Path of the Urine*, 2nd edit. p. 95.

This substance forms almost the rarest of known urinary calculi. Though obviously of renal origin it has not yet been found in the kidney, and therefore is not strictly included within the scope of the present work. Since Dr. Marcet, in 1817, described 'a nondescript calculus,' which he termed xanthic in reference to the reaction of nitric acid, I am aware of but four instances in which urinary calculi of this nature have been discovered. Its frequency.

Some pisiform concretions passed in a case of diseased bladder were shown by M. Langier, in the year 1829, to consist of this substance.

A stone removed from the bladder by Professor Langenbeck, of Hanover, a portion of which is in the Museum of the College of Surgeons and another portion at Guy's Hospital, the composition of which was detected by Professor Stromeyer, and investigated by Liebig and Wohler, furnished the next confirmation of Marcet's observations. A fourth specimen was removed from the urethra of a boy by Professor Dulk, of Königsberg, and the fifth and last was found by Mr T. Taylor, in the Museum of the College of Surgeons, and is described by him in the 'Pathological Transactions' for the year 1868. The stone was extracted from the bladder of a Mussulman boy by Mr. George Coles, a surgeon in the service of the East India Company: it had been in the college since the year 1851, and supposed to consist chiefly of uric acid.

Appearance and character. In appearance and hardness the calculi of this material which have hitherto been discovered have closely resembled uric acid. They are described as smooth and of a yellow or brownish colour. Dr. Marcet's calculus had a reddish cinnamon colour, and was compact and laminated. Langenbeck's was also laminated; it had a light brown colour, and was externally partly polished, of an earthy texture. This calculus, which is the largest yet known, was of about the size of a small hen's egg. A peculiarity of the material is its acquirement by friction of a waxy or resinous lustre.

Calculi of this material are readily soluble in caustic potash, xanthine being precipitated by acid from the alkaline solution as a white powder. Xanthine is soluble in nitric acid without effervescence, in that respect differing from uric acid, which dissolves with copious evolution of gas, the solution leaving on evaporation a lemon-coloured residue, which does not become red when acted upon by ammonia.

From the resemblance of xanthine to uric acid, whether it occur as a calculus or as an urinary deposit, it is probable that the formation is not so rare as is supposed, but is usually mistaken for uric acid.

Its clinical relations.

Clinically, what has been said regarding the formation of uric acid nearly applies to that of the oxide, since the oxide is but the acid incomplete by the want of its last stage of oxidation. Dr. Bence Jones, as the prophet of oxygen, was of opinion that with more of it the production of xanthine, as of uric acid, can be exchanged for that of more highly oxidised normal products, and recommends the restriction of fuel in the food, with resort to exercise, warm clothing, alkalies, and iron. Probably the formation of xanthine, as of uric acid, is not to be fully explained until more is known of its relations to definite organic change.

It has been stated that xanthine has been found in the urine as the consequence[1] of bathing in sulphurous water, and of the inunction of sulphur. It is difficult to see any connection between sulphur and uric oxide; if the statement had concerned cystine it would have corresponded better with our expectations.

OXALATE OF LIME AND THE OXALIC DIATHESIS.

Characters and local source of concretions of oxalate of lime.

Oxalate of lime forms the hardest and most insoluble concretions to which the human body is liable. They are soluble only in strong acids, not in any alkaline or slightly acid solutions, such as could reach them in their native cavities. They appear nearly always to originate in the pelvis or tubes of the kidney. Crystals of oxalate of lime of the dumb-bell shape are often found in the straight tubes, and these and octahedra have sometimes been seen in and upon casts. Dr. Beale noticed this in particular in connection with the suppression of urine of cholera. Of all urinary deposits the oxalate has the greatest tendency to cohere—some, like the amorphous urates and phosphates, adhere, and that with much readiness, to any dead surface, but they seldom concrete independently. Uric acid concretes independently, and the oxalate does so even more strikingly. Numbers of octahedra, or of dumb-bells, or of irregular lumps derivable from the latter, are often found under the microscope in concrete masses, the component particles sometimes held together by a translucent web like a film of structureless mucus, or maintaining their contact without visible means. Each mass so formed is a calculus in miniature, and needs but to stay in one of the urinary cavities to acquire concretion perhaps of other kinds. I have before me many sketches of microscopic concretions formed as I have described, which, however, I need not produce, as Dr. Beale has already illustrated the subject.[1] This tendency of the oxalate is a sufficient explanation of the frequency, upon which I have already dwelt (see p. 866), with which stones are originated by it.

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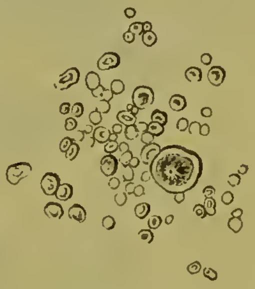
[1] Beale, *Kidney Diseases, &c.*, edit. 3, p. 371.

The material has a strongly crystalline tendency. Small calculi are often developed in the pelvis of the kidney which consist of aggregations of translucent crystals, which look as if they belonged to the mineral instead of the animal kingdom. In traversing the ureter, these produce severe, often agonising pain. The divergent groups of sharp spines or plates become the centre of stratified deposition, whence arises the peculiar tuberculated exterior by which oxalate of lime calculi, whether in the kidney or bladder, are characterised. The spiked or bossed exterior is often such as to give a resemblance, more genuine than most morbid similitudes, to a blackberry or mulberry. Though when oxalate of lime calculi are small they are often obviously crystalline, this is not always the case. They sometimes take the aspect of black or dark grains—black gravel as it has been termed—which much resemble poppy-seeds. Sometimes they are of a light colour. At the College of Surgeons are a number of renal concretions of oxalate of lime, which consist of minute polished spherules, which but for their faint yellowish tint might pass for a collection of small pearls.



A rare form of oxalate of lime. Small, smooth calculi, of which three ounces were found within a dilated kidney. (From a specimen in the College of Surgeons.)

Often these concretions attain a considerable size in the kidney, though they do not reach the enormous bulk occasionally presented by uric acid, and often by the phosphates. One of the largest renal calculi of oxalate of lime which I have met with is represented (woodcut, p. 886). It belongs to the College of Surgeons.

Sometimes a large number of calculi of this substance are found in one kidney, where their angular forms are well adapted to cause irritation. These calculi, from their hardness and close texture, take a high polish, and with their irregular stratification and variegated colour often resemble agates, and might well be applied to ornamental purposes, were the diseases of human beings like those of oysters resorted to for the production of jewellery.

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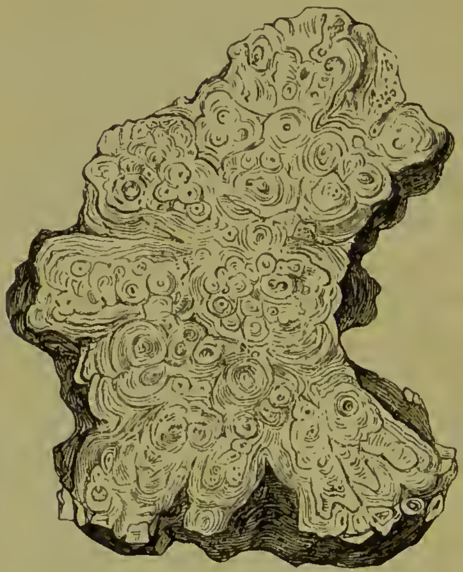
[1] *Kidney Diseases, &c.*, 3rd edit. plate xxxiii. p. 378.

It is probable that no varieties of renal calculi cause so much pain as oxalate of lime, though from the fact that they are less often disposed with bilateral symmetry, they are not such frequent causes of fatal suppression of urine as are concretions of uric acid.

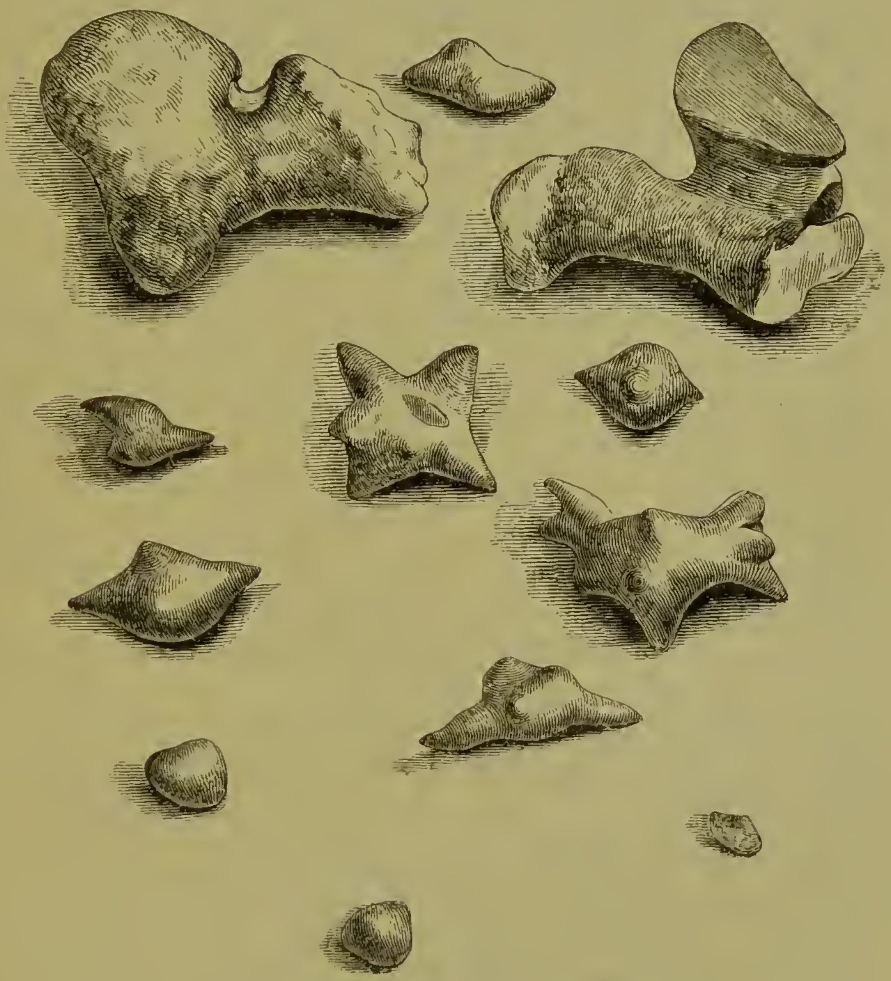
Circumstances which lead to the deposition of oxalate of lime.

What has been termed the oxalic acid diathesis has been, since it was first brought into notice by Prout, the subject of much discussion. The deposition of oxalate of lime in the urine has been regarded by some as a sign of the gravest disturbance of health, by others as of comparative insignificance. There is no doubt that crystals of oxalate of lime are often produced in urine by changes which have occurred subsequent to its secretion; while, on the other hand, it must be admitted that the habitual production of these crystals is often associated with a condition of nervous depression akin to that which attends the excessive secretion of lime in any shape.



Oxalate of lime calculus from the kidney, consisting as seen in section of aggregated spheres. (From the illustrated catalogue of the College of Surgeons.)

So much as concerns the formation and prevention of concretions of the oxalate may be briefly stated. Oxalate of lime is precipitated only in acid urine. Oxalic is closely allied to uric acid, uric acid being it is said convertible by the addition of oxygen and water into oxalic acid and urea. Dr. Owen Rees has shown that by virtue of some such change when urine containing urates is heated, oxalate of lime is produced. He believes that this conversion is of very frequent occurrence, and is in fact the only source of oxalic acid in the urine.



Remarkably pointed calculi, consisting of oxalate, with a small proportion of phosphate of lime. The kidney in which they were found was ruptured by the fall of a brick upon the loins. (St. George's Hospital.)

Whether or no oxalic acid in the urine is usually thus produced, we have evidence that it may also appear in this secretion after having been swallowed, and on the strength of this possibility persons prone to the deposition of the oxalate have been made to abstain from rhubarb and sorrel, too often an ineffectual injunction, for practically the development of the salt, as will be presently shown, is a question more of lime than of oxalic acid.

That this acid is more often developed within the organism, whether in the urinary cavities or elsewhere, than introduced from without is evident from the frequent and abundant discharge of it, though all food known to contain it be excluded. According to Dr. Bence Jones, the 'oxalic diathesis,' like other forms of acidity, is a result of the insufficient action of oxygen and the arrest at the stage of oxalic acid of the process of oxidation, by which the hydrocarbons of food should be transmuted into carbonic acid and water.

Influence of lime in determining the formation of the oxalate.

But what is of more practical importance than this hypothetical development of the acid is the influence of the base. Given excess of lime in the urine oxalic acid, come it from whence it may, is seldom wanting. Whether it be that an abundance of lime accelerates the process of decomposition by which oxalic acid is made from other urinary substances, or whether this acid is more generally secreted with the urine than has hitherto been thought, the excess of lime only bringing into view what previously existed, from one of these causes or some other it is certain that if much lime be passed with the urine, whether as a consequence of the excessive ingestion of this earth, or otherwise, some of it will usually appear as oxalate.

If chloride of calcium be added to healthy urine crystals of oxalate of lime will generally be thrown down. Similarly, if lime in the form of lime-water or oxalate of lime be administered for a few days to a healthy person the lime will reappear in the urine, partly as phosphate, and, so long as the urine remains acid, partly as oxalate. A similar production of oxalate of lime probably occurs from the continued drinking of water highly charged with lime; hence the known frequency of urinary calculi in limestone districts. It may be generally stated that when the urine contains excess of lime, if the secretion be normally acid, much of the lime will appear as oxalate; if it be slightly acid or neutral, as acid or crystalline phosphate; if alkaline, as amorphous or basic phosphate.[1]

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[1] For further particulars upon the action of lime-salts upon the urine, I may refer to some observations I made in conjunction with Dr. Bence Jones, the results of which have been published by him in the *Trans of the Chemical Society*.

Clinical aspect of the oxalic diathesis.

The practical issues of what has been stated with regard to oxalate of lime may be briefly explained.

When this deposit is formed persistently in copious clear and pale urine, it may generally be regarded as the result of secretion, and a sign of a constitutional state. When it is found in high-coloured or lithatic urine it may possibly have resulted from a decomposition of urates, and be without clinical significance.

According to Dr. Prout, the oxalic diathesis is more common in men than in women, it affects chiefly persons of either a sanguine or a melancholic temperament, it is often associated with affections of the skin, and it is apt to be developed by residence in a damp or malarious district. The association of oxalate of lime and malaria is of interest in connection with intermittent hæmaturia, a disease which is connected with ague, and in which crystals of oxalate almost invariably abound. Often the deposition is associated with flatulent dyspepsia, and with nervous depression and irritability, though it is by no means certain that the state of the nervous system is not more often the cause than the consequence of the disturbance. Dr. Bence Jones thus describes the symptoms of the 'oxalic diathesis':—

'The most common symptom is flatulent dyspepsia; frequently before food considerable uneasiness is felt and eructation occurs. Eating for a time removes the symptoms, only to return, in an hour or two, with increased intensity. The pain sometimes is so severe, persistent or intermitting, that it can only be produced by actual cramp of the muscular coat of the stomach. This state of suffering may last from half-an-hour to three or four hours, and then cease to return for some days, months, or years. In the urine the presence of oxalate of lime may be suspected when sudden changes in the quantity made in twenty-four hours are observed. Usually an increased urgency and frequency of making[1] water accompanies this increased flow, and there is a general feeling of irritability of the nervous system, exaggerating external and internal annoyances to a degree far beyond that to which they would give rise if no dyspepsia existed.'

It is certain, however, that while such disturbances are often found in conjunction with the deposition of the oxalate, they may equally occur as a result of the gouty condition without any production of oxalate of lime in the urine, and further that oxalate of lime may be precipitated abundantly in persons who appear to be in perfect health, and neither present the symptoms nor possess the constitutional characters which have been associated with the oxalic diathesis.[1]

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[1] It may be added that the presence of oxalate of lime in the urine of children is often associated with nocturnal incontinence.

The *oxalic diathesis* is a condition which has been considered too much as an isolated one, instead of being connected, as it is, with that tendency to pass earthy salts in excess which is so constantly associated with an active, restless, or irritated nervous system. Oxalic, like other earthy deposits, are found in persons of a nervous temperament, who have pale complexions, pass abundant light-coloured urine, and for the most part lead studious and sedentary lives.

Its treatment

As to the treatment of the *oxalic diathesis*, or in other words, the prevention of the concretion of oxalate of lime, it is obviously advisable to inhibit hard water, and by way of theoretic accuracy, the vegetable vehicles of oxalic acid, rhubarb and sorrel. If there be any tendency to concretion the free use of distilled or soft water is indicated.

by diet

Dr. Prout, seconded in this respect by Dr. Bence Jones, held that the diet should approximate to that now commonly enforced in diabetes, of which meat and spirit and water form the staples. Sugar, according to Dr. Prout, should be entirely prohibited. French cookery, 'by which animal matters are reduced to a semi-fluid or pultaceous mass,' agrees better, according to the same authority, than the 'solid chops or steaks of this country.' Dr. Basham, however, nowise assents to these views. He commends 'good English fare, neither a vegetable diet nor an animal diet prevailing,' and I think that experience is with Dr. Basham. Persons who pass lime freely, though often dyspeptic, need a liberal diet, one not too narrowly restricted. Plainly cooked meat, without the exclusion of vegetables, and with a little non-saccharine wine—claret or light sherry—may be generally resorted to, while in some cases distinct benefit will follow from the occasional admission of port wine or bitter ale.

exercise,

It is scarcely necessary to insist on the use of fresh air and free exercise in this condition, whether regarded as one of imperfect assimilation or nervous disturbance.

and medicine.

As medicine, nitro-muriatic acid has been reputed since the days of Prout to prevent the deposition of oxalate of lime, and there can be no doubt that the reputation is deserved. Strychnia, with or without the acid, is often of the greatest use, apparently correcting the conditions of nervous system in which the tendency takes its rise. Quinine and iron are less generally useful.[1]

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[1] For some valuable information upon this subject I may refer to Dr. Roberts's work on *Urinary and Renal Diseases*.

Phosphatic Calculi and the Phosphatic Diathesis.

Description of phosphatic calculi;

Three varieties of calculi are found in the kidney, consisting of earthy or ammoniacal phosphates—the calcic phosphate, the ammonio-magnesic phosphate, and the fusible calculus, which is a mixture of the two.

of the calcic phosphate;

Calcic Phosphate, or bone earth, $Ca_3P_2O_8$, in an unmixed state, is rare as an urinary concretion. Calculi of this material are generally chalky in appearance, or with a faint brownish tinge. They are often laminated concentrically, while their outer surfaces are polished. The material cannot be fused with the blowpipe. It dissolves readily in hydrochloric acid, from which solution it is precipitated in a gelatinous state by ammonia.

A deposit of this nature, derived as it is from urine which is alkaline, but not ammoniacal, is very apt to be succeeded by the triple or mixed phosphate, which ammoniacal urine induces, for the obvious reason that alkaline urine is apt to become ammoniacal. Stones of this nature, therefore, seldom or never attain a large size uncomplicated by other deposits. Indeed, stones of pure phosphate of lime of any size are among the rarities of pathology. The largest and best-described collections in London, namely, those at the College of Surgeons and St. George's Hospital, contain no example.

When the concretion of phosphates is established, though one kind of phosphatic deposit may be overlaid by another or by carbonate of lime, it is almost unknown for uric acid or oxalate of lime to be deposited, bearing out the statement of Dr. Marcet, that the phosphatic diathesis is never succeeded by any other.[2]

of the triple phosphate;

The ammonio-magnesic or triple phosphate $(H_4NM_gPO_4)$[3] is the product of ammoniacal urine. It rarely occurs as a primary deposit, excepting as an incrustation upon a diseased surface. It forms a coating upon stones of every sort, being deposited wherever the primary concretion causes enough mucous irritation to make the urine in the pelvis ammoniacal by the admixture of diseased secretion. The substance is white, soft, and friable, of loose texture, seldom laminated, often sparkling with crystalline grains. It fuses with difficulty before the blowpipe, giving an ammoniacal odour. Dilute acids dissolve it readily, and the solution when neutralised with ammonia deposits it again in a crystalline form.

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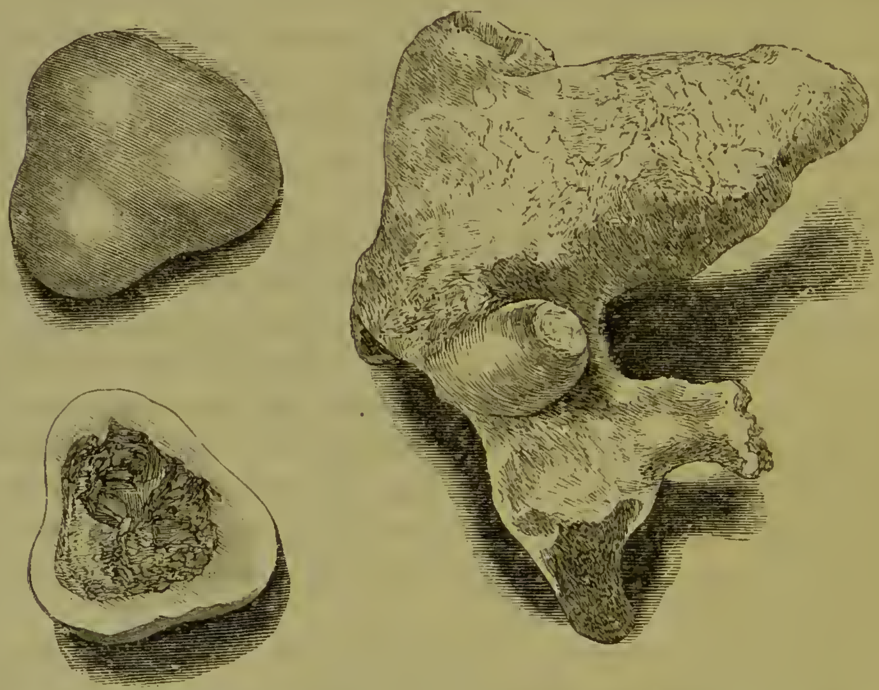
[1] In relation to the phosphatic diathesis see also the chapter on Phosphuria.

[2] Dr. Roberts mentions a calculus (probably vesical) in which uric acid alternates with bone earth; this, however, is exceedingly rare.

[3] I have known as an exceptional circumstance the ammonio-magnesian phosphate to be deposited, and that most copiously, and immediately upon the emission of the urine, when that secretion has been alkaline, but not appreciably ammoniacal or decomposed. A striking instance of this occurred in

The general aspect of calculi largely composed of this material may be learned from the accompanying woodcuts.



Two calculi from the same kidney, the smaller of which is entirely composed of triple phosphate; the larger externally of the mixed phosphates. (St. George's Hospital.)

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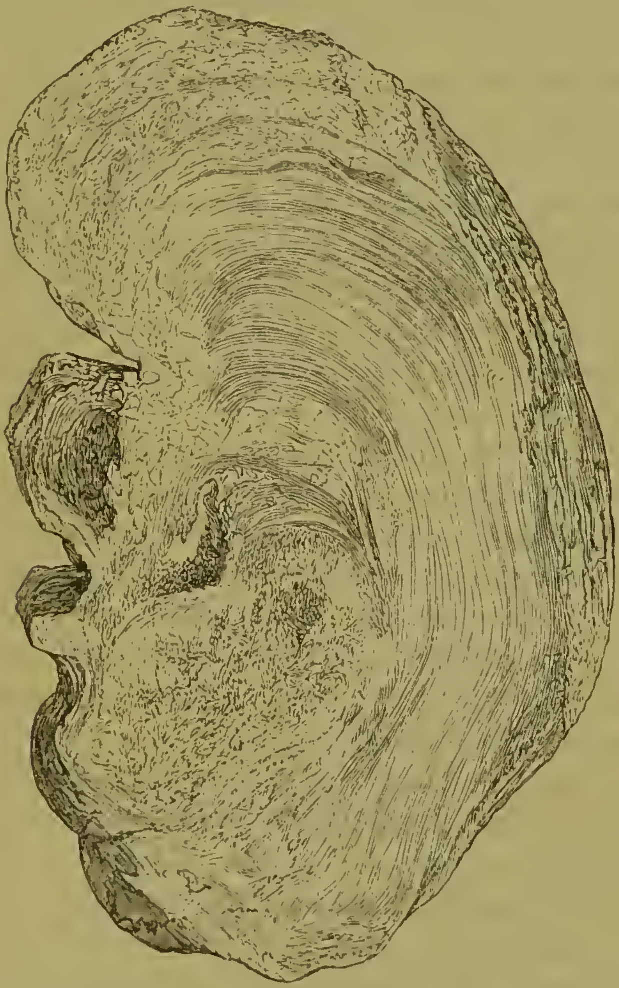
case of tubal nephritis, in which recovery took place. The ammonia was of course present in the urine, though not in a volatile form, probably the result of secretion, not of decomposition. It may be noticed also that there are special circumstances in which crystals of the same kind are habitually found in acid urine, though not formed in it. The urine in the pelvis of one kidney may be ammoniacal from stone or other local disease, while that in the other kidney is healthy, and the mixture in the bladder acid. The ammoniacal crystals may escape complete solution in the bladder, but present in the corrosion of their outlines signs of partial solution, which may be generally taken as evidence of unilateral disease.

The first represents two calculi which lay together in the same kidney, the larger of which is partly, and the smaller entirely, composed of the triple phosphate. The smaller stone in being thus solely composed of triple phosphates, hardly need be regarded as an exception to the rule that this deposit is always consequent upon some other, since the smaller stone was probably secondary to the larger, and resulted from the mucous disturbance it set up. A renal stone of almost pure triple phosphate, which weighed seven and a-half ounces—one of the largest on record—is represented in the annexed woodcut. The calculus was taken from the body of a daughter of the well-known Sir Richard Steele; the kidney had been reduced to a mere cyst.



Renal calculus, weighing seven and a-half ounces. Nearly pure phosphate of magnesia and ammonia. The central part is confusedly crystallised, the rest laminated. (From the illustrated catalogue of the College of Surgeons.)

Mixed phosphates, or the fusible calculus of Wollaston, conof the mixed phosphates.

sisting of a mixture in variable proportions of the calcic and the ammonio-magnesic phosphates, is far more frequently met with than either of its components alone. It is deposited in similar circumstances to the triple phosphate by alkaline and ammoniacal urine, in general connection with inflamed mucous membrane. It encrusts foreign bodies, calculi of all kinds, morbid growths, and roughened or inflamed membrane. It collects about urinals, or wherever urine is allowed to putrefy. A quantity of it, which had been scraped from the bottom of a chamber vessel which had been seldom emptied, and never cleaned, was once sent to me from a remote part of Great Britain. The urine had been passed by a gentleman who had symptoms of renal calculus, but the collection of this deposit indicated only that his urine had been allowed to decompose, subsequent to its emission. The same process may, of course, occur within the urinary cavities, as well as externally to them.

Calculi, consisting mainly of this material, vary much in size, often attaining a great bulk. They are often of very irregular shape, curved and branched, so as to follow the shape of the pelvis. In their irregular and fantastic shapes and earthy white outsides these calculi often resemble rough flints fresh from the chalk. They are loose and friable generally, but not always, showing stratification on section. Their substance often sparkles with minute crystals of triple phosphate. It fuses readily before the blowpipe; it is soluble in dilute acids; from its solution ammonium-oxalate separates calcic oxalate, and pure ammonia throws down ammonio-magnesic phosphate.

When calculi are of large size, whatever their internal structure may be, they are almost invariably coated either with mixed or triple phosphate.

A good specimen of a renal stone composed externally of the mixed phosphates is seen in woodcut (page 892).

On the deposition of phosphates in the kidney.

Of late years much light has been thrown upon the precipitation of the earthy and ammoniacal phosphates. Prout—the accuracy of whose observations of disease must give his work permanent value, however time may modify his chemical theories—thought that the deposition of the triple or earthy phosphates was necessarily owing to their superabundant secretion in the urine, and associated grave symptoms of nervous prostration and irritability with their presence as urinary sediments. It is probable that Prout did not over-estimate the clinical significance of these deposits, though later observations have shown that the earthy phosphates, though not existing in more than their natural amount, may be deposited by urine simply because it is wanting in acidity, and that the ammoniacal salt is the product of decomposition, not of secretion. Phosphate of lime is soluble in acid, but not in alkaline urine, and is thrown down wherever the urine loses its acidity. From urine which is neutral or barely acid the crystalline or acid phosphate is deposited. Decidedly alkaline urine deposits the neutral or amorphous phosphate. So long as the urine remains free from ammonia the lime-salt will be thrown down without any ammoniacal admixture, and a stone, should one form, will consist of phosphate of lime unmixed with the triple phosphate—a rare variety of calculus. Urine alkaline only from fixed alkali is generally unconnected with any local irritation in the urinary tract, and is unmixed with mucus. The sediment, therefore, is loose and powdery, and has little tendency to cohere into calculi. If the urine be ammoniacal, the deposit will be mixed, containing ammonio-magnesic, in addition to the calcic, salt. Possibly under such circumstances the ammonio-magnesian salt may be in much the larger proportion, and may concrete almost by itself. The concretion is facilitated by the mucus, which in such cases is always present. With this dependence of phosphatic calculi upon alkalescence of urine, it is necessary to revert to the conditions under which fixed and ammoniacal alkalinity occur.

Circumstances which determine alkalinity of urine,

Urine alkaline from fixed alkali has been so secreted. It is secreted ammoniacal only in exceptional circumstances. If ammoniacal, it has almost invariably become so subsequent to secretion as a result of putrefactive change, and the conversion of urea into carbonate of ammonia. When urine is primarily alkaline from fixed alkali, it the more readily takes on ammoniacal decomposition, for which reason the deposition of the calcic is likely to be early succeeded by that of the mixed phosphate.

when from fixed alkali;

The urine may be alkaline from fixed alkali, either because the alkalies or lime are in excess, or the acid, especially the phosphoric, deficient. The condition is usually associated with a depressed state of health, especially involving circumstances of nervous depression. Many conditions of serious chronic disease have been mentioned as thus accompanied—phthisis, dyspepsia, chronic vomiting, gout, chlorosis, &c. It sometimes happens that the urine is thus alkaline at an advanced stage of granular degeneration of the kidney; under these circumstances the condition is one of evil augury, as it appears to depend upon defective elimination of phosphoric acid. Apart from states of health, the urine may obviously be rendered alkaline by medicines containing potash or soda, their carbonates or their vegetable salts, which in the body are converted into carbonates, or by fluids containing lime, such as lime-water, or, as has been used experimentally, the solution of the acetate.

Fixed alkalinity of urine as a morbid condition, unconnected, that is, with food or medicine, suggests a treatment of a generally tonic character, in which mineral acids, perchloride, or other salts of iron, and quinine, strychnia, or other vegetable bitters are included. The condition, however, comparatively seldom occurs unconnected with some other morbid state, on which the management of the patient will chiefly depend.

when from ammonia.

Ammoniacal urine becomes so, as a rule, in consequence, as has been stated, of change subsequent to secretion, and is therefore a sign of diseased urinary cavities, rather than of alteration of blood. Instances have, however, been recorded in which there is reason to believe that the urine has been secreted ammoniacal.[1] I could not doubt that this was so in the case of a feeble old lady who often passed ammoniacal urine when more than usually debilitated, the normal condition of the urine being as often restored by mineral acids and tonic treatment. The urine of advanced renal disease often has a fishy and distinctly ammoniacal smell, together with an alkaline reaction, and must be presumed to have been so secreted when, as often happens, the cavities and passages are free from disease.

Dr. Graves[2] mentions two instances in which carbonate of ammonia was apparently present in urine when secreted. It may be accepted as a rule which has few exceptions that whenever the urine is ammoniacal to the smell, or, in other words, contains carbonate of ammonia, it has become so in the bladder or pelvis of the kidney as the result of local disease, comprising either retention of urine or inflammation of the urinary membrane, or both. Urine retained in the bladder by mechanical obstruction or from loss of expulsive power decomposes, becomes

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[1] *Urinary and Renal Diseases*, p. 29.

[2] *Clinical Lectures*, 2nd edit., vol. ii. p. 272.

Relation of morbid discharges to ammoniacal urine.

ammoniacal, sets up thereby vesical inflammation, and thus becomes mingled with morbid mucous products, which intensify its putrescence, and add to its irritating properties. The urinary mucous membrane is apt to discharge, when irritated by calculi, morbid growths, or retained urine, alkaline fluid, which, by acting as a ferment, causes decomposition. From this or some similar reason urine mixed with the products of mucous inflammation rapidly decomposes and acquires ammonia. A calculus, whatever its composition, if it be such as to cause much mucous irritation, is apt to be bathed with ammoniacal urine intermixed with mucous or muco-purulent flux. The earthy and triple phosphates are necessarily precipitated, while the tenacious mucus binds them together into a coherent form, thus supplying all the conditions needed for the formation and retention of calculous matter. The precipitate supplies the stone, and the mucus, so to speak, adds the mortar. Calculi of vast size thus accumulate. It used to be thought that under some circumstances the urinary mucous membrane actually secreted earthy matter instead of, as now understood, only causing its precipitation. The abundance of the phosphatic accumulation in some cases is enough to suggest that there may be truth in the old view; but I am not aware that any observations have been made as to the amount of earthy salts in urinary mucus, nor would it be easy to obtain it in sufficient quantity for analysis unmixed with urine.

Stones produced by ammoniacal urine.

Any source of irritation in the pelvis, or any means by which the urine is rendered ammoniacal, may determine the formation in this situation of a mixed phosphatic calculus. Probably most calculi of this kind take their rise in a concretion of oxalate of lime or uric acid. Others originate in a clot of blood or a mass of agglutinated mucus. A phosphatic calculus in the kidney may arise from a state of urine set up by a stone in the bladder. A preparation recently added to the collection at St. George's Hospital may serve as an illustration. The bladder, that of a child, contains a large uric acid stone partially encrusted with phosphates. Each kidney contains an irregular, elongated calculus of mixed phosphates accurately moulded to the shape of the pelvis. It would seem that the uric acid stone developed in the bladder until it at last caused by its irritation an ammoniacal condition of urine, and became consequently coated with phosphates. The ammoniacal urine regurgitated, or the mucous inflammation travelled upwards until the ammoniacal condition prevailed in the pelves. Precipitation then took place in both kidneys, until the cavity of each was filled with the earthy deposit almost as regularly as if plaster of Paris had been artistically poured in.

The ammoniacal state of urine connected with paralysis of the bladder from disease of the spine or cord, or the vesical inaction which may accompany typhus and other febrile states, is occasionally productive of phosphatic calculi in the bladder,[1] and possibly sometimes also in the kidney. Dr Thudichum[2] analysed a stone which had been formed in the bladder as the result of typhus, and found it to consist of the ammonio-magnesic phosphate with but a minute admixture of the calcic phosphate.

Treatment of ammoniacal condition.

When the urine is ammoniacal the first thing to be done is to inquire into the condition of the bladder, prostate, and urethra with a view to removing any stone or other source of irritation or obstacle which may be found. I do not propose to trench upon the domain of surgery, but may briefly say that the indication is to secure a free exit for the urine in such a manner as not to exasperate existing inflammation or introduce septic agents into the bladder. The frequency with which fatal renal suppuration follows the use of the catheter makes the instrument one of the most deadly of all the means of offence possessed by the surgeon. There can be no doubt that antiseptic precautions lessen the danger (see p. 652).

A free exit to the putrefying urine having been secured, the mucous membrane may right itself, and nothing more may be needed. Should the cystitis persist, great good may be sometimes done by acids, of which the mineral, nitric and nitrohydrochloric, answer best. Such remedies by the mouth correct the alkalinity of the urine, and take away its most irritating property, by preventing the evolution of ammonia. In some cases vesical injections of nitric acid and quinine may be called for, while pareira and uva ursi form useful adjuncts. Good living is generally necessary.

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[1] See the remarkable case of Sir Walter Ogilvie, recorded in the catalogue of calculi belonging to the College of Surgeons, part i. p. 116. An attack of paraplegia, consequent upon an accident, was succeeded by the formation in the bladder of a calculus of mixed phosphates, which eventually attained the weight of forty-four ounces.

[2] *Pathology of the Urine*, 2nd edit. p. 335.

CALCIC CARBONATE.

Concretions of carbonate of lime are often formed in the prostatic ducts, whence they escape into the bladder or with the urine in the guise of vesical calculi. Whether such stones ever originate in the cavity of the bladder is yet uncertain: we have evidence that they sometimes do so in the kidney. Whatever their actual origin they present, as obtained from the urinary cavities, tolerably uniform characteristics. They are usually numerous, of small size, and more or less spherical shape, often comparable to peas or hemp seeds. They are generally yellowish, translucent, and very hard, though some have been described as friable, or capable of being cut with a knife. They are finely laminated concentrically, and were found by Dr. Roberts to display a cross with polarised light. The calculi he describes consisted of carbonate of lime, readily detected by effervescence with hydrochloric acid, deposited upon a well-marked organic matrix discernible after the solution of the earthy matter, and usually mixed with more or less phosphate. The influence of a colloid fluid in determining a globular instead of a crystalline shape is well illustrated by these calculi. There is reason to believe that of all calculi those of carbonate of lime are most closely dependent in their origin, not so much upon urine as upon pus and other products of disease within the urinary cavities, and the prostatic secretion within its own channels. As an urinary formation this substance is of exceeding rarity save as a secondary deposit.[1] It has indeed been doubted whether carbonate of lime[2] is ever deposited from the urine in the form of stone, but it is at least certain that it is thus thrown down either by the urine itself, or by pus or other

Their seat and character.

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[1] There is but a single specimen of carbonate of lime in the fine collection of urinary calculi at the College of Surgeons; and this, though it was removed from the bladder by lithotomy, is regarded by Mr. Taylor, with apparent justice, as of prostatic origin, having escaped probably by ulceration into the cavity from whence it was removed. The symptoms of stone in the bladder had been preceded by those of severe prostatic irritation. The stone contained 89 per cent. of carbonate of lime, the rest being oxalate and phosphate of lime, phosphate of magnesia and ammonia, and animal matter. See catalogue of the calculi in the College of Surgeons, by T. Taylor. Supplement i. series ix., li.

[2] Thudichum, quoted by Ord, *Influence of colloids upon crystalline form*, p. 142.

Rare, except as a secondary deposit.

morbid products mingled with the urine, and so not only sometimes forms a part of compound calculi, but may be the chief component of simple ones. In compound stones carbonate of lime is not rarely deposited with or after phosphates, the table gives five instances in which it has thus formed a component of renal calculi. As a concretion within the kidney, independently of any preceding calculous deposit, we have evidence of its occurrence in at least two instances.[1] For one we are indebted to Mr. Wagstaffe, whose description may be inserted as relating to a case in some respects unique.

Wagstaffe's case.

A large branching calculus was found in the right kidney, and had generally a dark-brown colour, though the portions which projected into the calyces were colourless and presented, where not in contact with other calculi, a translucent crystalline surface. A quantity of brown sand and several rounded loose calculi lay in the calyces.

This specimen, though solitary, is not deficient in variety, presenting, *multum in parvo*, five different forms of the calculous deposit.

1. The mass in the pelvis was of a dark-brown colour and very hard, closely resembling uric acid in appearance.
2. The projections in the calyces, when not exposed to pressure or attrition, were apparently made up of shining white crystals somewhat like triple phosphate.
3. The small detached calculi were hard, smooth, and laminated.
4. Some of the free ends and some of the isolated calculi were covered with a dry, soft, opaque-white, pulverulent deposit, looking very much like phosphate of lime.
5. The small calculous grit had the shape of little brownish spherules, very hard and identical in appearance with uric acid. These were laminated in structure.

Each of these kinds proved to consist of carbonate of lime with a very minute trace of phosphate. They all evolved gas freely with hydrochloric acid, leaving in the case of the laminated spherules an animal matrix, which retained the spherical form.

The specimen was obtained from the body of a man forty-two years of age, who died of disease of the heart and cirrhosis of the liver. There was much anasarca. The urine was slightly albuminous but otherwise natural. The only symptom recognised in connection with the calculus was an attack of hæmaturia, which occurred rather more than two months before death, and lasted two or three days.

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[1] *Trans. of the Path. Soc.* vol. xix. p. 270.

Dr. Haldane found half a teaspoonful of sandy matter, held together by a flocculent substance, which resembled coagulated blood, in the pelvis of the left kidney of a man who had caries of the lumbar vertebræ The particles were generally of the size of grains of sand; some were as large as hemp-seeds. Dr. Roberts, who reports the case,[1] found the matter to consist of an animal matrix, impregnated with carbonate of lime mixed with a little phosphate. A few gritty particles were embedded in the cones of the right kidney, which were also found to consist partly of carbonate of lime.

Inferences as to origin of carbonate of lime concretions.

We may infer that carbonate of lime is precipitated from ammoniacal urine by the carbonate of ammonia which it contains, in company with the phosphates.

When the carbonate occurs alone, as in the case which has been related, we must presume that the phosphates were simultaneously formed, but failed to concrete. Possibly the capacity which carbonate of lime has of aggregating into spherules may explain its separation and retention apart from other deposits. When carbonate of lime forms a component of compound renal calculi, it almost invariably occurs subsequently to or in company with earthy or triple phosphate. In four cases out of five comprised in the table it occurred with or upon phosphate of lime, probably ensuing from the development of ammonia in urine previously alkaline.

CYSTINE AND THE CYSTINE DIATHESIS.

Composition and local origin.

Cystine ($C_3H_6NSO_2$) is one of the rarer of urinary concretions. It was called cystic oxide by its discoverer, Dr. Wollaston, because the earlier specimens were from the bladder, though it is perhaps more often found in the cavity of the kidney. It is remarkable for the quantity of sulphur it contains, no less than 25·5 per cent., or more than a quarter of its weight. This substance generally occurs alone, though it occasionally happens that a cystine calculus becomes coated with phosphates, and instances have been known in which cystine has been deposited upon uric acid or variously associated in calculi with phosphates, oxalates, and urates.

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[1] Roberts's *Urinary and Renal Diseases*, 3rd edit. p. 286.

Calculi of this substance appear generally, or at least frequently, to originate in the kidneys. They not unfrequently traverse the ureter and escape by the urethra in a lenticular or pisiform character. In the bladder they sometimes attain a considerable size, seldom, however, reaching the weight of two ounces. The largest known specimen is in the Museum of University College: it weighed, when entire, 850 grains. It was extracted from the bladder by Liston. The most numerous were those, nineteen in number, which were removed by Mr. Christopher Heath by lithotomy, three from the bladder, the rest from the prostate.[1]

Appearance and character.

Cystine is comparatively soft, forming stones which are favourable objects for the lithotrite. They have a waxy, semi-transparent aspect and crystalline structure. It has, when fresh, a decidedly yellow colour, which on exposure changes to a delicate leek-green. Cystine is insoluble in water, alcohol, and ether: it is dissolved by the stronger acids, by the caustic alkalies, and by the bicarbonates of potash and soda. It can generally be recognised by dissolving a portion in ammonia and allowing the solution to evaporate, whereupon the characteristic hexagonal crystals will be obtained;[2] when heated, cystine decomposes with a peculiar and disgusting odour.

Circumstances which lead to its formation.

The circumstances which lead to the formation of cystine are matters of conjecture. It is secreted as such by the kidneys in consequence, as we must suppose, of the superabundance of its elements in the blood. The sulphur may theoretically be attributed to the deficient oxidation of albumen. It has been shown that healthy urine contains sulphur not only as sulphuric acid, but also in an unoxidised state, and it is conceivable that an increase of sulphur in this state, owing to excess of sulphur or lack of oxygen, may result in the formation of cystine. Dr. Bence Jones thus explains the formation of cystine, as of much else, to depend on deficient oxidation, and from the composition of the substance, as well as from what little is known of the antecedents of those in whom it has been developed, there is some warrant for such a theory.

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[1] *Path. Trans.* vol. xxvii. p. 306; also vol. xxix. p. 154.

[2] It is to be observed that uric acid will sometimes, though rarely, take the shape of hexagonal plates, which in form and appearance are not to be distinguished from cystine.

Dr. Prout mentions eight cases of which the antecedents were ascertained in which cystine as calculi or crystals was found. One of the subjects was described as bilious or dyspeptic, one as leading a sedentary life, another as a stout and corpulent woman, a fourth as having indulged freely in eating, as well as in spirits and wine. These facts, however, may be looked at from a different point of view. Many circumstances point to the liver as the source of cystine, and to cystinuria as but a sign of hepatic derangement. Cystine, as pointed out by Dr. Roberts, is closely similar to taurin in composition. Cystine has been found in the liver of typhoid patients. In some cases cystinuria has been associated with jaundice or other evidence of hepatic disturbance.

Relation to hepatic derangement.

In the year 1876 I saw, with my friend Dr. Glover, of Highbury, a member of our own profession, who had habitually passed cystine crystals with the urine since the year 1856, and at intervals since this date three calculi of the same substance, with symptoms of their having come from the kidney.

The patient, when I saw him, had extreme ascites, with evidence of obstruction of the portal vein, which his eventual recovery indicated as thrombotic. He had established no claim to hepatic disease by his habits, which had always been active and abstemious, but his dark hair and sallow complexion pointed to what is called a bilious temperament; and disturbance, connected apparently with hepatic inaction, was frequent with him. A second attack, apparently of portal thrombosis, more severe than the first, and attended with hæmatemesis profuse enough to endanger life, occurred during the year 1880. During convalescence from this at Lowestoft, the cystine was observed to be unusually abundant. It was noted that bile was almost absent from the stools, the previous inactivity of the liver having been aggravated apparently by the influence of the locality. No hereditary proclivity has been traced in this case; there are several sons and daughters, in none of whom has cystinuria been discovered.

The patient from whom the cystine calculi were removed by Mr. Christopher Heath was found after death to have a liver which is described as 'amyloid and somewhat enlarged.'

It must be allowed, however, that the clinical associations of cystinuria are too various to warrant any conclusive deduction on this head. Cystine has been passed with the urine without any other noticeable disturbance of health, by children frequently, and in later life for years together. It has been passed by scrofulous, tuberculous, and chlorotic persons, as well as by many who present none of these conditions: persons habitually exposed to wet and cold, like a sexton, operated on by Mr. Southam,[1] of Manchester, have been the subjects of cystine concretions, and in one instance calculi of this kind were found in the kidneys of a lunatic[2] who was intemperate, while in many cases no pathological association has been noticed or recorded.

Often inherited.

The most striking clinical peculiarity of cystine is its tendency to run in families. Many cases have been recorded in which brothers, or brothers and sisters, have passed or concreted it, others in which a cystine calculus has descended as an heirloom from father to son. Dr. Marcet mentions two brothers who died, one at the age of thirty, the other between thirty and forty, with symptoms of renal calculus, cystine stones being found in the kidneys of both. A calculus was extracted from the urethra of a third brother, but its nature was not ascertained. Both Lenoir and Civiale extracted cystine calculi from the bladders of two brothers.[3] A boy was cut for stone by Mr. Teale, of Leeds, and a cystine calculus removed. Two of his brothers passed crystals of cystine with the urine.[4]

According to Poland, out of twenty-two collected cases of cystine calculi, ten occurred in four families, while in three cases the subjects of the complaint were brothers. Golding Bird alludes to an instance in which cystine was found in the urine in three successive generations.

Treatment of cystine diathesis.

As to the treatment of the cystine diathesis we have, from the rarity of the condition, little experience. Dr. Prout advises the avoidance of indigestible food and the use of nitro-muriatic acid; Dr. Bence Jones urges measures of oxidation. In deference alike to every view we may commend abstinence and exercise, while, if there be apparent need, medicines of cholagogue repute may be employed.

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[1] *Brit. Med. Journ*, Dec. 23, 1876.

[2] Dr. Risdon Bennett, *Path. Trans.* vol. iii. p. 383.

[3] Roberts's *Urinary and Renal Diseases*, p. 219.

[4] Related by Dr. Beale, *Kidney Diseases, Urinary Deposits, and Calculous Disorders*, 3rd edition, p. 386.

INDIGO.

Instance of its concretion in the kidney.

On the observation of Dr. Ord [1] indigo must be added to the list of substances which may concrete in the kidney. The left kidney of a woman of middle age had been destroyed by a soft, round-celled sarcoma, and reduced by obstruction of the ureter to a closed cyst, which contained a branched earthy calculus of which nothing further is related. The right kidney was hypertrophied and somewhat hyperæmic, but healthy in structure. In its pelvis was found a calculus of the size and shape of a fruit lozenge and the weight of forty grains. This was partly of a dark brown and partly of a blue-black colour, granular and without polish. It made a blue-black mark on paper, and gave chemical reactions characteristic of indigo, of which its bulk consisted. Associated with this was a small quantity of phosphate of lime; and the brown part of the stone displayed crystals of hæmin.

Circumstances in which indigo has been found in the urine.

The existence of indigo in the urine has often attracted notice; its concretion never before. Little is positively known with regard to the source of indigo in the urine, except that a substance indistinguishable from it appears in this secretion after the ingestion of creasote or carbolic acid, the former of which, as Dr. Ord informs us, had been taken by the patient from whom the calculus was obtained. Apart from this mode of introduction circumstances of two kinds are to be recognised as often preceding the discharge of this pigment, or a substance easily convertible into it, with the urine—the confinement of pus within the body, and disease of the intestines. I displayed at the Pathological Society [2] some urine which contained an amount of indigo I believe unexampled, which had been passed by a young woman in whose abdomen was found a circumscribed abscess, which held at least two quarts, in connection with an ulcer of the stomach. Dr. Ord points out that some such retention with consequent absorption may have occurred as the cause of the indigo calculus, since the kidney, in which it was not, had been destroyed while its exit was closed. That pus is occasionally associated with pigment has been testified by the green and blue colours known to have been presented by this secretion. With regard to intestinal disturbance as preceding the escape of indigo and allied substances with the urine, we have the examples of Asiatic cholera and obstruction of the bowel of various kinds, the result being due, as is suggested,[1] to the non-escape and consequent absorption and excretion of *indol*, a product of pancreatic digestion which has a near chemical relation to indigo.

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[1] Ord, *On the influence of colloids upon crystalline form*, p. 141; also *Path. Trans.* vol. xxix. p. 155.

[2] *Path. Trans.* vol. xvi. p. 181.

FIBRINOUS AND BLOOD CALCULI.

Concretions to which these names have been applied may receive a passing notice, more especially as they are sometimes very hard, and passed with as much pain and difficulty as if of stony substance. The fibrinous calculus of Marcet has been described as of much the colour and consistence of bees' wax, and as presenting the reactions of fibrine. Other concretions have been more distinctly sanguineous, and have given evidence in colour and structure of the presence of blood-corpuscles. Such an instance, which was observed at the Consumption Hospital by Dr. Scott Alison, is recorded and figured by Dr. Beale.[2] The kidney was reduced to a thin sac, which weighed but one and a-half ounce. The infundibulum and pelvis were stuffed with hard bodies, most of which were of a coal-black colour, but some whitish grey. The black calculi, which were chiefly within the pelvis, were about six in number, and ranged from the size of a coriander seed to that of a horse-bean. They were hard but friable; they were soluble in ammonia, and displayed forms which were thought to be the remains of blood-corpuscles. The grey calculi which were in the infundibulum were apparently phosphatic. It is probable that the changes originated in these or other calculi of one of the ordinary types by which the ureter was obstructed, the kidney transformed, and hæmorrhage produced, the blood being retained within the closed cavity to undergo further changes.

Their character,

and probable origin.

It has been supposed that the so-called fibrinous calculi were the product of an albuminous exudation from the kidney, but this is hypothetical: it is more consistent with experience to regard these as blood-clots modified by time and maceration. Vermiform coagula from the ureter are well known, as also are the lumps of cancer[1] which are sometimes expelled from the bladder in disease belonging to this organ; these cannot be called calculi, though they may possibly become encrusted so as to give rise to them.

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[1] Thudichum, *On the Urine*, 2nd edit. p. 179; also Ord, *loc. cit.* p. 149.

[2] *Kidney Diseases*, 3rd edit. p. 409.

UROSTEALITH.

Not a renal concretion.

A fatty or saponaceous substance, to which this name has been given, has been met with as forming the chief bulk, or the central portion only, of concretions which have been found in the bladder or passed from it. It does not appear ever to have been seen in the kidney, and therefore does not fairly come within the scope of this work. The best known and earliest described specimens are the two in the College of Surgeons,[2] in each of which a lump of fatty or soapy material, consisting of oleate and margarate of lime, has become involved with concentric layers of phosphates, so as to present the exterior of a common vesical calculus. The fatty centre in one case presents a section as large as a sixpence, the other is not much smaller. There is no reason to doubt the explanation provided by Mr. Taylor, that these concretions have been produced by the injection of soap into the bladder for the cure of stone or some affection mistaken for it. The soap in this view has been decomposed by the urine, the alkali forming soluble salts with the urinary acids, and the fat concreting with the urinary lime. Nearly resembling these 'soap-stones,' and possibly of a similar origin, though, as in the Hunterian case, we have no history to bear out the supposition, were some concretions which were passed by the urethra, described by Heller in the year 1845, and dignified with the name Urostealith. A peculiarity of these fatty bodies was a resinous or aromatic odour emitted on combustion. Later, some apparently similar calculi were described by Dr. Moore.[3] Two passed from the bladder were of a brown colour, and consisted of fatty matter in combination with lime. Of two removed from the body of the same patient, presumably

Its artificial origin.

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[1] See case which I contributed to *Path. Trans.* vol. xx. p. 233.

[2] Catalogue of Calculi, part i. published 1842, p. 129, plate xi.

[3] *Dublin Quart. Journ. of Med. Science*, vol. xvii. May 1854, p. 473.

from the bladder, one was a common phosphatic stone, the other, which was as large as a hen's egg, consisted of phosphate of lime and fusible calculus externally, while within was a cavity containing, but not filled by, a quantity of the same dark brown fatty substance which was found in the concretions which had before been passed.

We know that fat is passed abundantly with the urine when chyle becomes mixed with it, but there must be considerable doubt as to whether oil or fat in a separate form and tangible quantity is ever a product of renal secretion.[1] A few instances have been reported in which oil or fat has been found in the urine, and believed to have been secreted with it; it has even been supposed that a dose of castor oil has been chiefly eliminated by the kidneys; further observations are needed before the intervention of error, accident, or fraud can be looked upon as altogether outside the question.

DIFFERENTIAL DIAGNOSIS OF RENAL CALCULI.

It may be convenient to condense into a few sentences the chief considerations by which we can ascertain, or with probability conjecture, the nature of a calculus lodged in the kidney.

Evidence of previously passed stones;

Should calculi have been previously voided and preserved they will give the most trustworthy information. It may, as a general rule, be inferred that stones left behind or subsequently formed are of the same nature as those which have escaped, or differ from them only in the acquirement of a phosphatic crust.

Information will be given by the habitual reaction of the urine. Uric acid and oxalate of lime are deposited by acid urine, phosphate of lime by urine alkaline from fixed alkali, mixed or triple phosphate by ammoniacal urine.

If the urine be constantly acid and free from pus or mucus it may be presumed that a renal calculus consists either of uric acid or oxalate of lime, or of both together.

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[1] Beale, *Kidney Diseases*, 3rd edit. . 315.

It must be borne in mind that the vast majority of renal calculi consist either solely or centrally of one of these substances.

of reaction of urine;

Crystals of uric acid or oxalate of lime, if numerous, and particularly if they be present in the urine when passed, will furnish a presumption that if there be precipitation in the kidney it will be of the same kind. As between these two deposits, there will be an inference in favour of oxalate of lime if the urine abound in earthy salts, or, in other words, give a large precipitate with liquor potassæ. Uric acid will be pointed to should the patient be gouty, should the symptoms have originated in early childhood, or have dated from an attack of scarlatinal nephritis.

of its earthy precipitate.

Signs of uric acid;

Should the urine exhibit oxalate of lime, the inference that the calculus is of this nature will be strengthened should the patient be pallid, dyspeptic, and of a nervous temperament.

of the oxalate;

A persistently alkaline state of urine will lead to the inference that the stone, whatever be its centre, is encrusted with phosphates, which, should the urine be ammoniacal, will be of the mixed variety. The mixed phosphates being extremely common, and the pure phosphate of lime extremely rare, it may generally be reckoned that should circumstances indicate a phosphatic calculus in the kidney it is of the former kind; should much pus or mucus be passed phosphatic deposition may sometimes be inferred, even though the urine remain acid. It may happen that a stone in the pelvis of one kidney may cause the urine to be alkaline in that cavity and phosphates to be there deposited, while the acidity of the secretion is restored in the bladder by admixture with the healthy product of the unaffected gland.

of the phosphates.

Cystine, from its rarity, need not be suspected unless the characteristic hexagons are found in the urine. Should these concur with the symptoms of renal calculus there will be a considerable probability that the stone will be of unmixed cystine.

Urates seldom occur alone. Xanthine and carbonate of lime may, from their rarity, be omitted from diagnostic consideration. Urates and xanthine occur under similar circumstances to uric acid; carbonate of lime under circumstances similar to those which point to the mixed phosphates.

CHAPTER XII.

PATHOLOGICAL CONSEQUENCES, CLINICAL RELATIONS, AND SYMPTOMS OF RENAL CALCULI IN GENERAL.

Patholcgical Consequences.

Position of stones.

When calculi lie in the kidney, they usually rest in the expanded commencement of the ureter, or cling to the calyces; very rarely they are embedded or encysted in the renal substance.[1] When lying in the pelvis they are apt to obstruct the outlet, and cause more or less hindrance to the exit of urine. If the stone is of suitable size and softness, as happens especially with uric acid, it may be worn by the friction of the mucous membrane to fit the origin of the ureter with water-tight accuracy, as in the case represented at page 954. In other circumstances, notably with hard mulberry calculi, the concretion is not exactly adapted to the outlet, and instead of forming a prohibition to the escape of urine, scarcely interposes a difficulty. Considering the incomplete closure first, this results in a gradual dilatation of the mucous cavity of the kidney with commensurate atrophy of the secreting structure. This sometimes is, and sometimes is not, accompanied by pyelitis. The pelvic mucous membrane takes on inflammatory action less readily than the vesical, whence urine retained in the pelvic cavity, less largely intermixed with mucous secretion, has not the same prone-

Their effects upon the kidney,

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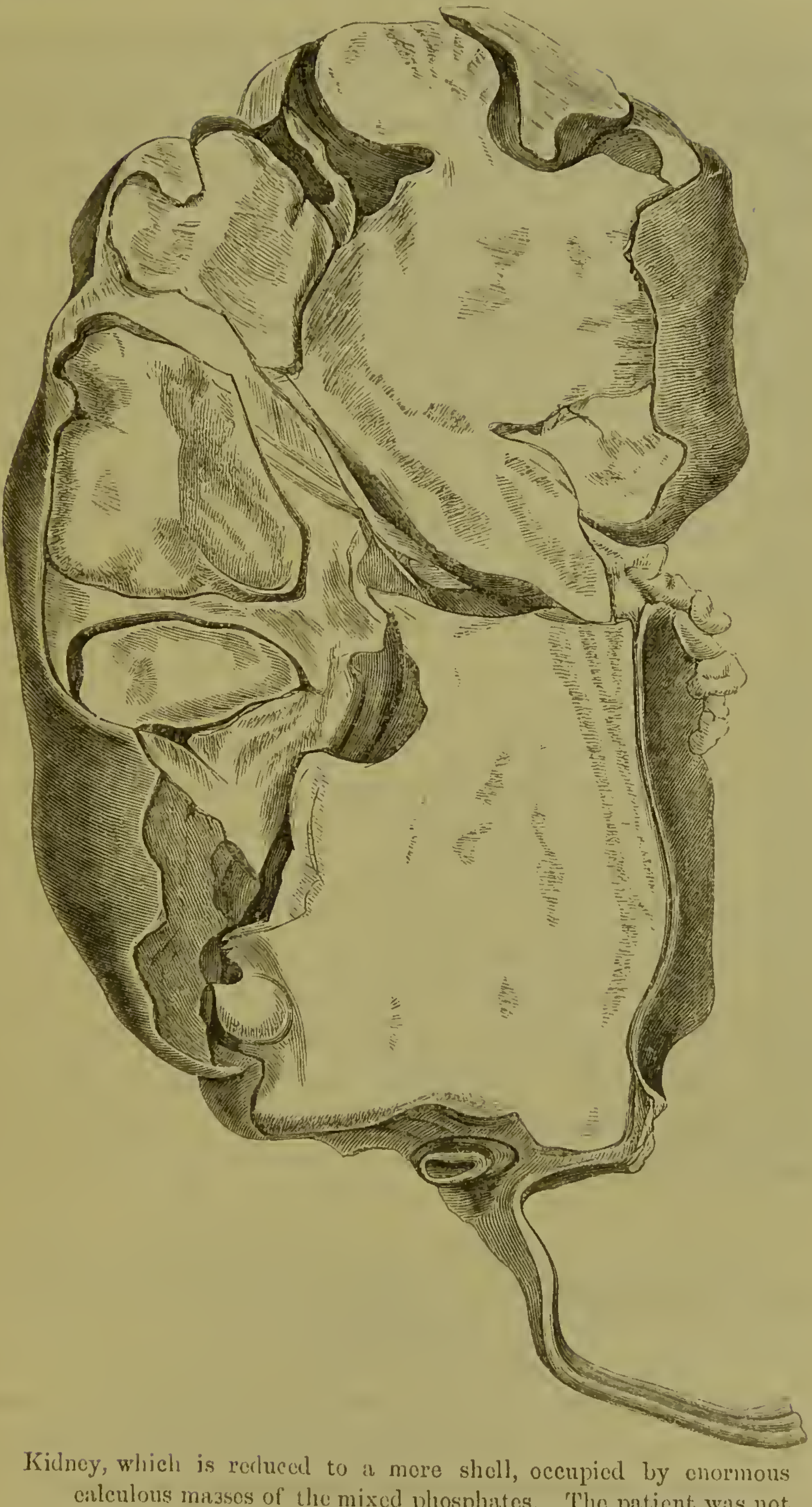
[1] In the museum of Guy's Hospital there is a kidney the cortical part of which contains a cyst the size of a hazel nut, in which are some small calculi. The cyst has a narrow communication with the pelvis, and has probably been formed by an obstruction in the straight tubes and accumulation behind.

ness to putrefactive change as when in the bladder. Hence it may come to pass that simple dilatation, with corresponding attenuation and atrophy of the kidney, may be the only pathological results of a renal stone.

atrophy and dilatation.

The kidney is sometimes reduced to a mere husk, in which a stone is encased. This process is usually connected with pyelitis, as explained in connection with the origin of phosphatic calculi. The kidney may be dilated as the result of stone to an extent which varies from a trifling increase in the size of the pelvis to such an expansion that the organ may occupy the greater part of the abdominal cavity. The extreme extension does not take place unless the obstruction is so nearly impassable as only to open at times and under pressure. The organ under these circumstances becomes transformed into a multilocular cyst, which retains little of the kidney save its fibrous tissue and something of its shape. The pelvis gradually stretches, and consentaneously atrophy of the secreting structure takes place. Where the pyramids terminate in the mammary processes, the tubular structure is in immediate contact with the accumulating fluid. To its steady pressure their soft structure gradually yields, so that each pyramid is first flattened at its point, then encroached upon more and more until, partly from atrophy and partly from displacement, the position of each cone is occupied by a deep inlet from the pelvis. This inlet widens and deepens at the expense, first of the medullary, then of the cortical structure, until at last it reaches the capsule, which comes to form its outer boundary, while on each side it meets with cavities similarly formed, and approaches them more and more closely until only condensed fibrous tissue keeps them apart. The kidney thus comes to consist of a central cavity corresponding to the pelvis, into which open a number of chambers divided by fibrous septa. In this it may not be possible, even with the microscope, to find any tubes left, but such a complete and total destruction of the secreting structure is rare (*see* woodcuts at pages 825 and 826), for in cases where no kidney-tissue has



Kidney, which is reduced to a mere shell, occupied by enormous calculous masses of the mixed phosphates. The patient was not known ever to have had renal symptoms. (From a preparation in St. George's Hospital.) Case related by Mr. Holmes, *Path. Trans.* vol. x.

been evident to sight, it has been found that the contained fluid has still possessed urinous qualities. It commonly happens that thin isolated patches of brown tissue, which are remnants of glandular structure, can be seen in the walls.

Pyelitis and colloid as results of stone.

By the time that extreme dilatation is reached it commonly happens that more or less suppurative inflammation has occurred in the lining membrane, and the urinous contents have become mixed with pus or mucopurulent matter. Colloid matter also has been known to form in the cavity. I have already referred to a cyst,[1] nearly a yard in circumference, which consisted of a kidney, dilated and partitioned as the result of calculous obstruction, which had become thus occupied. The dilatation of the kidney from calculus takes place gradually and painlessly, and when unaccompanied by any discharge of pus or by disease in the other kidney almost harmlessly.

General effects of calculous dilatation.

As one kidney is destroyed the other undertakes a compensating hypertrophy, and maintains the function. In slight cases the condition of the organ often escapes notice until after death. When the dilatation is great an obvious fluctuating tumour is found, the characters of which, especially if they be corroborated by a history of calculus, may suffice in a male subject to point to the nature of the case. In the female it may require some care to distinguish a renal from an ovarian cyst. Further details relating to the diagnosis of renal cysts are to be found elsewhere (p. 721).

CLINICAL RELATIONS AND GENERAL SYMPTOMS OF RENAL CALCULI.

Renal calculi originate sometimes in the tubes, more often in the pelvis of the kidney. Uric acid, the urates, oxalate and phosphate of lime, have been recognised in the tubes by the microscope. They never attain a considerable size in this situation, but reach the pelvis as sand or grit, thence to escape or there to grow. In the pelvis calculi vary widely in number, shape, physical characters, and size. The pelvis may contain a single stone, two, or more, up to a multitude which may be reckoned by hundreds. In size the concretions range from the minutest aggregation of crystals or smallest laminated spherule, up to a mass of stone weighing nearly a pound. In shape they have generally, if small, more or less of a spherical or ovoid shape, or retain a crystalline outline; if large, they are generally moulded upon the pelvis, sometimes adapting themselves with deadly accuracy to the outlet of the infundibulum. The particular characters of each variety of calculus have been severally detailed. It only remains here to allude to such general considerations as are of importance clinically.

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[1] See page 743.

Their general disposition.

One kidney or both may be affected. The deposition of uric acid, oxalate of lime, and cystine, arising as it does from a state of blood, is apt, with perilous consent, to occur in both kidneys simultaneously or in succession. Phosphates, springing from local causes, are less often disposed with bilateral symmetry. Both kidneys are affected far less often than one only; where one only is affected the right has a slight pre-eminence.

Relations to side, sex, and age.

Of fifty-nine cases in which renal calculi were found after death at St. George's Hospital, both kidneys were thus occupied in eleven cases; one only in forty-eight. The stone was on the right side in twenty-five cases, on the left in twenty-three.

Males, according to the same showing, are more subject than females to renal calculi. Of sixty cases thirty-six belonged to the male, twenty-four to the female sex. This preponderance may be attributed to the greater addiction of males to excess and their greater liability to gout and the formation of uric acid.

With regard to the age at which renal calculus presents itself, I may refer first to that at which it proves fatal; and for this purpose appeal to the sixty cases already mentioned which, as representing nearly forty years' experience of a general hospital, may be taken as demonstrative in many respects of the distribution and issues of the formation in question. In forty of the sixty cases in which renal stone was found, death was due to causes independent of it; in twenty it was produced more or less directly by the stone. Of three people who have stone one will die of it; thus far is the disease fatal and no farther. There appear to be two periods at which death is prone to occur: between twenty and thirty, and between forty and fifty. The earlier date probably belongs to the stones which are originated, as so many are, in infancy or early childhood; the latter to those which are developed by the habits and accidents of adult life.

Age at death with *and* from *renal calculus. From Post-Mortem Books of St. George's Hospital.*

Age at Death	Of 60 persons who died *with* renal calculus	Of 20 of the number who died *of* it
0 to 9 years . . .	1	0
10 ,, 19 ,, . . .	3	0
20 ,, 29 ,, . . .	15	7
30 ,, 39 ,, . . .	4	2
40 ,, 49 ,, . . .	12	5
50 ,, 59 ,, . . .	14	3
60 ,, 69 ,, . . .	8	1
70 ,, 79 ,, . . .	2	1
80 ,, 89 ,, . . .	1	1

Of the patients referred to, the youngest died at the age of one year, the oldest at that of eighty-eight.

It is evident that renal calculi take their rise more often before than after middle age. It is probable that the uric acid concretions of the first few days of extra-uterine life often form their nuclei, while it has been shown that scarlatina not seldom leads to a deposition of the same kind. Thus calculi with a centre of uric acid may be often traced to infancy or childhood. With regard to oxalate of lime it would seem to be more often deposited after than before puberty. It is extremely difficult, from the frequent latency of the disease, to obtain satisfactory clinical evidence as to the time at which in any particular case it originated; but it very frequently happens that it can be traced back from middle or advanced age to childhood or early life.

Ordinary symptoms, their variety.

Stone in the kidney varies more than most disorders in its history, its symptoms, and its issues. It generally makes itself known by pain and bleeding, but these symptoms are not always present. It is sometimes latent and apparently harmless. Occasionally stones of enormous size are discovered in the kidney after death (see woodcut, page 893), though no renal disturbance had been known to exist at any period of life. In other cases a renal stone produces an amount and persistence of suffering which entitles it to be regarded as one of the most unwelcome, as it is one of the most tenacious, companions that a man can travel withal. Stones in the bladder may burst, or disintegrate, and come away piecemeal, but it does not appear that renal stones are capable of this process of natural lithotrity.[1]

The stone may lie in the infundibulum, which, as has been stated, it may be moulded to fit, or one, or several may be seen holding tenaciously to the calyces. A calculus of considerable size may have its lower part in the infundibulum, while the upper end is jagged or branched, so as to be adapted to these points of discharge.

The symptoms which it causes depend first upon the contact of the stone with the sensitive and irritable mucous membrane, producing pain, inflammation, and bleeding; secondly, upon the mechanical hindrance to the escape of urine, whereby the kidney becomes variously damaged by extension and pressure, and whence, should both kidneys be involved, fatal suppression of urine may result. Putting aside for the present the consequences of obstruction, we may consider the more ordinary symptoms of renal calculus, which are those associated with irritation and hæmorrhage.

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[1] See paper, by Dr. Ord, on the 'Spontaneous disintegration of vesical calculi,' *Path. Trans.* vol. xxxii. p. 304.

The kidney is brought by the pneumogastric nerve into sympathy with the stomach, by the spermatic plexus into relation with the course of the ureter and substance of the testicle, with the cremaster muscle and skin of the inside of the thigh by means of the genito-crural nerve, while the anterior crural nerve establishes a less direct communication between the kidney and other parts of the lower extremity.

Prout describes the most frequent symptoms produced by foreign bodies in the kidney as being lumbar pain, gastric disturbance, retraction of the testes, and bloody urine.

The kidney is not only a highly vascular organ, prone to discharge blood on small provocation, but it is endowed with extensive nervous connections, the influence of which we see in many phases of disturbed action under the irritation of a stone.

So long as a stone is perfectly quiet it may cause no pain, nor any symptoms by which its presence can be recognised. Hence it often happens that a very large calculus tightly embraced by an atrophied kidney is latent; but immediately the stone stirs in the pelvis, or, if small enough, when it enters the ureter, the extensive sympathies of the organ are awakened.

There is a distinction between the symptoms produced by a stone as it lies in the kidney, and as it traverses the ureter. Dealing first with the symptoms of an imprisoned or unvoidable stone they are widely various. To quote the words of Prout, 'the pain produced by the presence of renal concretions differs almost infinitely both in kind and degree.'

Pain.

The pain is generally of a dull kind, a sense rather of weight than pain, felt at times in the loin of the affected side, and possibly more or less in the other, though one kidney only is diseased. The pain sometimes passes along the course of the ureter into the testicle, which may be retracted, swollen, and painful, and into the thigh, affecting especially its inner surface, which often becomes numb. Sometimes the pain reaches or appears only in the lower parts of the limb; a case is recorded in which obstinate pain in the knee was found after death to have been associated with a renal calculus. I had a patient in whom the chief pain caused by a concretion of this nature was in the sole of the foot, and another in whom much of it was in this position: in the latter instance the sensation was 'as if the sole were raw and being rubbed with scouring-paper.'

Tenderness.

There is often some degree of tenderness over the affected kidney either in the back or on deep pressure of the abdomen a little on one side of the umbilicus.

Effects of bodily movement.

The pain is generally inconstant, often absent or trifling during bodily quiescence, aggravated by movements, especially such as are jerking or tremulous. Of all modes of locomotion walking is the best borne. It is sometimes found that when the pain is of the paroxysmal neuralgic type, pedestrian exercise, with its concomitants of fresh air and change of scene, lessens the frequency and severity of the attacks.

Riding on horseback is more constantly injurious, as also are the jolting or vibratory movements of a carriage.

With regard to the sensations produced by a stone in the kidney, Howship observes that even a small calculus will in some cases excite a distinct impression as to its existence in the patient's mind. In one instance he found a small stone not larger than a pea in the kidney, with scarcely any evidence of consequent irritation, where the patient had for two years been conscious of a stone in that situation. He alludes to another patient who was made aware of the presence of stones in her kidney by their grating together on movement of the body.[1]

Appreciable grating of stones upon each other.

Recently my colleague, Mr. Pick, ascertained the existence of stones in the kidney by making them grate upon each other perceptibly to himself by pressure of the hands before and behind.

Pain varies with composition of stone.

Prout observes,[2] with general truth, that of renal concretions lithic acid produces the least pain, what there is being dull, oppressive, and connected with a sense of weight: oxalate of lime causes pain of a more acute kind, and that often referred to a particular spot over the region of the kidney, and sometimes discursive, shooting in the direction of the ureter, epigastrium, or shoulder. Phosphates he has found to be attended with great suffering—almost unremitting, though paroxysmally aggravated.

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[1] Howship, *On the Urinary Organs*, p. 105.

[2] *On Stomach and Renal Diseases*, p. 298.

These distinctions correspond with much of our experience. Severe neuralgic anguish is undoubtedly most apt to occur with long-standing calculi, which are, at any rate, superficially phosphatic, though it must be allowed that sometimes, as in the instance before referred to, such stones become absolutely innocuous.

Posture.

The pain of a renal stone often affects habitual posture. The sufferer may seek relief by lying on his belly, on his back, or on the unaffected side. A gentleman told me that in his attacks of pain, which came on with daily regularity, he 'lay on the floor and wriggled like a worm.' Sometimes positions are habitually taken which have an appearance of constraint, but which, as has been taught by sad experience, are those in which the injured organ has to bear least pressure. A gentleman thus affected observed that in sitting he always instinctively lounged to one side, while in walking he had a peculiarity of gait by which he could be recognised at a distance, due to a lateral bend of the body, the shoulder of the affected side being the higher. Another patient habitually sat with the knee of the affected side held up by his clasped hands, thus relaxing the muscles of the abdomen. Sometimes pressure gives relief, as in the case of a gentleman who found most ease while kneeling upon a chair with his abdomen bent over the back.

Varieties of pain produced by stone exemplified.

In some, fortunately rare cases, the pain caused by a renal calculus is of almost unendurable severity. It is not always easy to explain the differences which are observed in this respect. A distinguished member of our own profession, who has been aware for some thirty years of the presence of a stone in one kidney, and has carried on a laborious practice under circumstances of bodily suffering by which many men would have been rendered incapable of any sustained pursuit, describes the pain, which originates in one lumbar region and passes horizontally outwards and forwards, as being of an extreme acuteness, like pain ordinarily described as neuralgic. Attacks of intense agony frequently recurred, the more often when, from other circumstances, the general health was below par, necessitated an immediate interruption of business or pleasure, and a recourse to chloroform at the earliest available moment. Such attacks often occurred at night, insomuch that for many months together this gentleman never dared to go to bed without a bottle of chloroform under his pillow, the inhalation of which he found to be the only mitigation of his sufferings. The duration and intensity of the suffering which may arise from a renal calculus are exemplified in the life of Robert Hall, the eloquent Nonconformist, of whom it is said that from his infancy to his death, in his sixty-seventh year, he was seldom free from severe pain. When he was six years old he often had to lie down on his road to school to relieve a pain in his back, and through his subsequent life this pain, which increased with his years, was seldom absent, and often agonising. It was aggravated by sitting or standing; he could seldom sit for more than an hour together, and passed a large proportion of his life in a horizontal position. He wrote one of his most celebrated sermons lying upon the floor. He was accustomed to stretch himself upon three chairs, the posture in which he found most relief. For more than twenty years he never passed a whole night in bed, but was compelled after a short sleep to get up and seek ease in his favourite attitude. Intolerant as he was of sitting, he often found relief from walking, and it was even thought for a time that horse exercise was beneficial. The intensity of the pain compelled him to have large recourse to opium; in a single night he was known to take nearly four ounces of laudanum. He found alleviation also from smoking, an art which he had acquired in order to qualify himself for the society of Dr. Parr. The sufferings of his last illness, which was mainly dependent upon disease of the aorta, were cruelly aggravated by his inability to breathe in the horizontal posture, which was imperiously demanded by the lumbar pain. After death, the cause of his sufferings, which during life had remained undiscovered, was found to be a large, rough pointed calculus, which entirely filled the right kidney. It is worthy of remark, as illustrative of the frequent coincidence of renal calculus with mental disease, that this gifted man was twice insane.

Gastric disturbances.

Gastric disturbances, nausea, vomiting, and various forms of indigestion, are, next to pain—with which the disturbance of stomach is, as Prout observes, generally commensurate—the most frequent symptoms of renal calculus. The sympathy between the stomach and kidney, under these circumstances, probably depends upon their community of supply by the pneumogastric nerve, the irritation of the renal being reflected to the gastric branches. The action of the stomach is variously interfered with.

Vomiting frequently occurs, often with the evacuation of nearly pure bile; this being in some cases so far the most prominent symptom that its renal origin may escape notice. Nausea, acidity, flatulence, and gastrodynia occur in every permutation, being, as sometimes necessarily happens, enhanced by the gouty disposition of the patient. Attacks of stomach-disturbance are often coincident with pain, hæmaturia, and the other signs of increased renal irritation.

Affections of testicle

Retraction, pain, and variously perverted sensations in the testicle of the side affected are sometimes early and prominent signs of renal calculus. When the pain is long continued the affected testicle is apt to swell and become tender. Sometimes, instead of drawing up, the scrotum becomes relaxed or affected with a sense of coldness or numbness. These sensations are often associated with numbness or pain on the inner surface of the thigh. Neuralgia of the testicle has been known as the chief symptom of renal calculus, as in a case of renal lithotomy reported by Mr. Butlin.[1]

and of bladder.

Irritation of the bladder, and that to a distressing degree, may be a direct or indirect consequence of stone in the kidney. A young woman died under my care in St. George's Hospital with symptoms of pyelitis, which might have been the result of either stone or tubercle; but her distress was almost wholly vesical; the urine, which was persistently purulent, was passed with much frequency, pain, and difficulty, and the catheter often needed. Both kidneys were occupied by large, rough stones; the bladder and urethra were perfectly natural; the vesical trouble wholly of renal origin, no doubt in part due to the irritation of the purulent and alkaline urine.

Hæmaturia;

Another result of renal calculus is hæmorrhage—less profuse than from growths, and not frequent enough to cause marked depletion or call for styptic remedies.

As an exception to this statement I may mention the case of a lady who was reduced by habitual though not profuse hæmorrhage, the result of a renal stone, to a condition of exceeding anæmia, as evinced both in appearance and constitutional symptoms, and was greatly benefited by iron.

The hæmorrhage of calculus is rather constant or oft-repeated than copious, though in all these respects it is subject to great variation. In some cases it is seldom absent, in others never present; in some it constitutes almost the only evidence of a renal concretion.

its dependence upon movement.

The great peculiarity of hæmaturia from this cause is its dependence upon movement; it recurs with exercise or locomotion and ceases with rest. Thus the urine is found to be bloody during the day or on going to bed,[2] rather than during the night or on rising in the morning. This is the converse of what occurs as the result of cancer or villous disease; the supine posture of sleep appears to favour the accumulation of blood in renal growths, whence they are more apt to bleed in the night than the day.

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[1] *Clin. Trans.*, vol. xv.

[2] Renal hæmorrhage, presumably from stone, may come on without external provocation, and possibly be preceded by some sensation which will enable the experienced patient to foretell its advent. A distinguished army surgeon, who has presumptive evidence of a renal calculus, finds that an attack of hæmaturia is usually preceded by sleeplessness; a night or possibly two

The blood from renal calculus, though sometimes enough to tint the urine in a manner alarming to the patient, is in other cases in so small quantity that it cannot be detected except with the microscope. The blood is yielded by the mucous membrane of the pelvis and not by the kidney-tubes; it is consequently not moulded into casts, but occurs as an incoherent sediment mixed, should the hæmorrhage be large, with minute indefinite clots. The blood is generally less intimately mixed with the urine than occurs when hæmaturia is the result of disease of the substance of the kidney; it less often forms the persistently smoky or porter-coloured mixture so often found with albuminuria; but the globules readily subside and form a coloured stratum, in which sometimes shreddy clots may be detected, the superincumbent urine having its natural appearance. The deposit is coffee-coloured when the urine is acid; red or pinkish when it is alkaline.

Character of the bloody discharge.

Different stones are accompanied with different tendencies to hæmorrhage. Oxalate of lime, from its crystalline, spiky, or tuberculated exterior, produces most, phosphatic calculi the least. Concretions composed of or coated with phosphates, associated as they necessarily are with local inflammation, are usually surrounded with thickened and altered mucous membrane, which is more apt to yield pus than blood.

It is to be noted as a possible source of erroneous diagnosis that the local irritation of stone will sometimes cause a cast or two, which I have sometimes noticed to contain epithelium, to show themselves in the urine, even

during which he is sleepless, but not restless or otherwise disturbed, is followed by pain at a spot in one renal region, and that by hæmorrhage.

though it be practically certain that there is no disease general to the renal structure.

Distinctions of calculous hæmaturia from that of

It may be worth while briefly to sum up the distinctions by which the hæmaturia of stone can be distinguished from other conditions of renal bleeding. (See chapter on Hæmaturia.) I presume that in the case under consideration it has been ascertained, by the absence of symptoms referable to the bladder, that the blood proceeds from the kidney. The common causes other than calculus of the discharge of blood from this organ are albuminuria, purpura or scurvy, intermittent hæmaturia, tuberculous, malignant, or villous growths. In deciding between either of these and stone we shall have regard to the existence of the symptoms or history of renal calculus, or of the passage of gravel. Beyond this every other form of hæmaturia has characters which distinguish it from the hæmaturia of stone.

disease of substance of kidney;

With albuminuria, beyond the evidence afforded by casts, the urine contains more albumen than the superadded blood suffices to account for, and remains albuminous when it has ceased to be bloody.

of purpura and scurvy;

With purpura or scurvy, as in albuminuria, the blood is apt to be involved in casts; beside which hæmorrhages occur at the same time in other parts of the body.

With intermittent hæmaturia the blood-corpuscles are destroyed; with calculus, they remain distinct.

of malignant and villous growths,

With regard to malignant or villous disease the distinction is often a matter of some, though seldom of insuperable, difficulty. Growths cause more profuse hæmorrhage than does a stone, often producing, as a stone seldom does, conspicuous signs of anæmia. Bleeding from a growth is apt to occur during sleep, at which time the bleeding of calculus, depending as it does on movement, is diminished or quiescent. The urinary sediment, examined with the microscope, especially during the intervals of hæmorrhage, will sometimes display the vascular loops characteristic of villous disease. Should the growth be cancerous, and of the bladder, large, round, or flat nucleated cells may be abundantly seen in the urine; or even considerable fragments of cancerous growth may be expelled. If of the kidney the growth is usually sarcomatous, and the escape of cells or any distinctive elements with the urine is of exceeding rarity. The presence of the 'malignant cachexia' is a guide, though a somewhat untrustworthy one. The presence of a tumour in the renal region, together with hæmorrhage, may be generally taken as indicating a growth; for though a tumour may be produced by calculous obstruction, it does not often happen that blood proceeds from a kidney thus obstructed.

and tubercle.

The distinction between the hæmorrhage of scrofulous or tuberculous disease and that of stone may be of more difficulty. With both the blood may be mixed with pus; and with stone it is possible that there may be a febrile temperature, such as is more common with tubercle. The effect of movement is a guide; while with tubercle hæmorrhage is more often absent, and when present is less often repeated than with stone.

Signs of the passing of stones.

The symptoms which have been described, those which a stone produces by moving in the pelvis or irritating the membrane by ill-adjusted pressure, may, should the stone enter the ureter, become exaggerated and accompanied by agonising pain and much constitutional disturbance. To the symptoms of a pelvic calculus, the results of spasmodic contraction of the ureter are superadded. Spasm of involuntary muscle, always painful, is never more so than when the ureter is the subject and a calculus the cause. The painful passage of stone or sand along this duct constitutes what is described as a fit of the gravel. The patient is attacked, perhaps suddenly, after some exertion, jerk, or unusual movement, or without any external provocation, with acute pain in the loins, or in the course of the ureter, which shoots towards the testicle, groin, and bladder, and amounts in some cases to as severe agony as the human body has the power of making for itself. It may be, as Prout says, of such an overwhelming nature as, together with the sickness which accompanies it, to paralyse the stoutest individual. The pain is not at first associated with tenderness to any marked extent, though it may become so after a time. The attitude and manner of the sufferer who moves in restless anguish are characteristic of colic rather than inflammation. There is much constitutional or nervous disturbance. Shivering early comes on, or, short of actual shaking, horripilation, and a feeling of cold, to be succeeded after a time by more or less febrile reaction. With the cold the patient becomes faint, or even actually faints, and may display other signs of nervous disturbance, in the form of epileptic seizures or passing delirium. A medical friend, one whose nerves are not easily shaken, described his sensations on passing a mulberry calculus as an altogether novel experience. While in a hip-bath he was seized with an intolerable exacerbation of the pain, with a rushing in the head and wild confusion of mind, in which he sprang from the bath and ran unclothed out of the room. A few minutes afterwards he passed water and with it the stone, and was himself again. The unbearable pang marked the passage through the narrow termination of the ureter. The stomach early sympathises in the disturbance, nausea and sometimes urgent and repeated vomiting being among the first symptoms. When the stone is passing, especially from the left kidney, there is often so much discomfort and distension of the bowel that the attack is looked upon as intestinal colic, until the expulsion of the calculus provides the interpretation. There is much irritation of the bladder, small quantities of dark or bloody urine being frequently passed. The pain, as the attack continues, moves downwards, and sometimes terminates suddenly during a fit of retching, with a piercing exacerbation. The ureter is narrowest at its lower end, where it passes through the coats of the bladder. At this spot the stone is particularly apt to stick, as happened in the case to which woodcut, page 965, refers. Having passed this strait the stone falls into the bladder, and the attack is at an end. The time occupied by the process varies much, the symptoms are sometimes over in an hour or two; they sometimes occupy days, and have even been known to last, with little intermission, as long as three weeks.

The pain is not always such as has been described. After the first attack the symptoms are much milder; the ureter becomes dilated and tolerant. Even, for the first time, small, smooth stones are sometimes passed without any of the characteristic symptoms. Of all calculi those of oxalate of lime cause the most distress in their descent; uric acid, as a rule, the least.

The effects of suppression of urine, as caused by the impaction and movement of renal calculi, are separately considered (p. 951).

The following narrative was written at my suggestion by a respected member of the medical profession, who has frequently passed small crystalline calculi of oxalate of lime. It illustrates in a graphic manner many of the symptoms which attend the complaint in a not very severe form. It is to be premised that this gentleman had been in the habit of drinking hard water, and that freely:—

Case illustrating symptoms of the passage of stone.

"One day in February 1862, then having taken a sixteen or seventeen mile country walk, soon after going to bed I was seized with a severe pain in the right lumbar region, extending down the groin and through the pelvis. This was accompanied by retraction of the testicle on that side to such a degree that it was almost worse than the pain. On getting out of bed I could hardly stand upright; however, I managed to procure some twenty drops of laudanum, and soon after fell asleep. In the morning there was a slight appearance of blood in the urine, which was very acid. I was prescribed some alkaline saline with tincture of henbane, and in the course of a few days, after some more pain at night, relieved by hot hip bath and laudanum, I passed a small calculus. After this I was in my usual health and vigour for I suppose a year or more, when I had much the same train of symptoms, but I think if anything less pain. The next attack was again in about a year, when I was resident at the hospital and taking less walking exercise than formerly. Up to this time I had done very little by way of treatment, but as I had several attacks one after the other, I consulted Dr. Dickinson, and at his instigation put myself under regimen. I left off beer, fruit, pastry, reduced my consumption of vegetables, drank distilled water, and took nitro-hydrochloric acid. This treatment I continued for some months during the early part of 1865, and I certainly for a time was much better, and under the microscope the oxalate of lime crystals were scarcely to be found, whereas formerly they had been numerous. Towards the end of the year I suffered a good deal again, and having lived now nearly two years in the hospital, felt generally a little out of health, though I was not for a single day disabled from following my duties. At the end of 1865 I left town, and went to Bath for a week. During this time, after soaking for some time in the hot bath there, I passed a rather longer calculus than I had before discharged. After this I went to live at home, and for a long time was quite free from any symptoms, and so by degrees became careless of any restriction in diet. I generally found, however, that champagne or anything of that nature would cause vague lumbar pains, and I think I had one or two slight attacks of calculus, but I forget; I took no medicine, and did not examine the urine by microscope.

"In March 1868 I had an attack of scarlatina, but no renal mischief, and in numerous examinations never detected any albumen in the water. In August of that year, after a rough steamboat journey to Scarborough, I had some sharp lumbar pain, next day detected blood in the urine, and a day or two after passed a small calculus, having carried it about in my bladder some twenty-four hours or more. About Christmas that year I began to suffer from sciatica on the right side, and for months was not free from it. Once or twice, from sheer inability to move, I stayed indoors all day, but generally I managed to limp about as usual. I had at first no renal pain, though it came on subsequently. When the sciatica was not very severe, I contented myself with some restrictions in diet, merely such as leaving off beer; but when a severe attack came on I found relief from Vin. Colch. ʒss; Pot. Bic., Sodæ Bic., Pot. Nit. āā gr. xv.; Sp. Ammon. Ar. ʒss; Aq. ad ℥iss; once or twice a day, and the application of camphor liniment, and laudanum over the nerve at night. This generally produced relief in a day or two.

After going on in this way for some months I passed the largest calculus I had yet discharged, without much pain or any sedative. For some time before it passed, any unusual exercise, as running, dancing, &c., was sure to be followed by pain in the kidney, and sciatica, and by urine the colour of claret. Before finally leaving me the calculus remained some days in the bladder producing great irritation, and constant burning pain at its neck.

"After getting rid of this calculus I was much better for some time, but during the next twelve months I passed two or three small calculi at intervals, preceded generally by sciatica of two or three days' duration. I found that the colchicum and alkali, &c., always produced relief. In July 1870 I had been feeling rather 'renal' for some time, and one day sciatica came on so sharply that having to walk some two miles gave me exquisite torture, besides producing a feeling of great misery and depression. A hot bath, colchicum, &c., relieved me, and in a day or two I was rewarded with a calculus. In September I spent a week walking about twenty miles per diem in the Isle of Wight, and a day or two after my return got rid of a small calculus, with scarcely any pain or trouble. To sum up then, the attacks seem to come on indiscriminately in summer or winter, spring or autumn. And the calculus passes down the ureter either day or night, though generally by night. The pain is seldom sufficiently great to interfere with my appetite or rest, though generally producing some depression of spirits, particularly at the commencement of the attack. Often a slight degree of hæmaturia is the earliest indication, sometimes it is the pain. I have noticed that the amounts of pain or of hæmorrhage are not always proportionate to the size of the calculus, or to each other; sometimes there being more hæmaturia, sometimes more pain."

MODES OF DEATH.

The modes by which renal stone kills and their relative frequency may be fairly represented by the *post-mortem* experience of St. George's Hospital, which has been systematically recorded since the year 1842. Of sixty persons (see page 916), in whose bodies stones were found, twenty had died mainly by their means, forty from causes unconnected with them.

Causes of Death in 20 Fatal Cases of Renal Calculus.

Immediate cause of death	Number of cases
Pyelitis, uncomplicated	3
„ + Perinephritic abscess	3
„ + Lumbar abscess	1
„ + Suppurative peritonitis (rupture into peritoneum)	2
„ + Ulceration into bowel	1
„ + Lardaceous disease	2
„ + Cystitis	1
„ + General tuberculosis	1
„ + Granular kidney	1
Pyæmia	1
Suppression of urine (calculi in both kidneys)	1
Atrophy of kidneys	1
Mania + enlarged prostate and retention	1
Rupture, from blow, of kidney, which contained many pointed calculi	1

Suppuration.

Of the twenty who died of stone, sixteen did so in consequence of suppuration; pyelitis being present in all, and in three the chief cause of death. The extension of suppuration beyond the kidney into the circumjacent tissue, the peritoneum, the bowel, and the loin, is represented by seven cases—about a third of the whole. Lardaceous disease was recognised only in two instances; many of the observations were made at an early date; but it may be safely stated as the result of recent experience that death rarely ensues from pyelitis or chronic extra-renal suppuration without more or less of it. Fibrotic atrophy, with some dilatation of the pelvis, with or without the development of the granular condition marked organically and clinically, is a distinct result of renal stone, and is represented in the table. Pyæmia appears as the cause of death on the warrant of a case in which this condition proved fatal, but for which no cause could be discovered though laboriously sought, save a renal stone, which had been lately productive of bleeding. The locally disseminated suppuration of the 'surgical kidney' finds no place as a consequence of renal stone either within the table, or so far as I know outside it. It was found once in conjunction with renal calculus, but there was also prostatic

Renal fibrosis and dilatation.

Pyæmia.

disease, to which the suppurative lesion was at least in part to be attributed. Traumatic suppuration presents itself by chance. The kidney which contained the spiked calculi, represented at page 887, singularly ill-suited as they must have rendered it to endure violence, was ruptured thirty days before death by the fall of a brick. The cortex was found to be sprinkled with miliary abscesses.

CHAPTER XIII.

ON CERTAIN RESULTS OF RENAL CALCULI.

CALCULOUS PYELITIS.[1]

THE dilatation of the kidney which results from stone is often accompanied with suppuration of the pelvic mucous membrane, set up by the contact of the accumulated and decomposing urine. Suppuration under these circumstances is generally coincident with much extension and atrophy of the kidney; the converse also holds that much extension from calculous obstruction is seldom reached without more or less suppuration. The lining membrane first becomes vascular, traversed by vessels which in extreme cases may be so numerous and turgid that the surface looks almost black. Later appears the smooth, opaque, creamy surface of suppuration.

Pyelitis associated with dilatation.

The symptoms of early calculous pyelitis are those of pyelitis added to those of stone. Later, it is not unknown for the stone to have escaped or to have fallen into quietude and oblivion, the pyelitis only remaining evident. The pyelitis is first displayed by the urine, which contains mucus, though there be no signs of vesical inflammation. With this the microscope may show epithelial cells of various forms (see woodcut, page 665), and perhaps blood-corpuscles. The mucus, especially abundant when the stone is of oxalate of lime, sometimes makes its exit in tenacious gelatinous masses, which may cause scarcely less distress in traversing the ureter than stony concretions. After a longer or shorter time, particularly if the urine be

Changes in urine.

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[1] See also chapter on 'Pyelitis,' p. 658.

retained in the pelvis in considerable bulk, the mucus is replaced by pus. There is generally little doubt as to the renal origin of the discharge. The pus, when the condition is fully established, is apt to be eminently 'laudable,' unmixed with such foul and stringy discharge as proceeds from the bladder, its corpuscles displayed in a regular and typical form. Such matter separates readily and distinctly from the supernatant urine, which remains acid and inoffensive.

Urine of this nature, passed as it often is without frequency or any vesical disturbance, cannot fail to be regarded as of renal origin, a view which will probably be corroborated by the presence of unmistakably renal symptoms. Less often the urine is peculiarly offensive, and the discharge broken down beyond recognition, as the result of accumulation and putrefaction in the pelvis. In such cases it often escapes intermittently.

General symptoms.

There is usually pain either in the affected loin only, or sometimes in both, of a dull continuous kind; or there may be, in the same situation, a sense of weight or of heat. Uneasy sensations are also frequently felt in the course of the ureter and in the testicle. With these there is sometimes slight, sometimes severe and continuous febrile disturbance, with gradual loss of strength, loss of appetite, nausea, and even vomiting. Irritation of the bladder, apparently the result of nervous sympathy, evinced by frequency of micturition, sometimes occurs, especially in the early stage; it sometimes is sufficiently persistent and severe to raise a suspicion of disease of the bladder, though this organ be perfectly healthy. This is especially the case when the urine is alkaline.

Distinction from tubercular pyelitis.

It will be seen from the preceding description that there is seldom any doubt as to the renal seat of calculous pyelitis, but that a difficulty may occur in distinguishing calculous from tubercular suppuration. Should this fail to be solved by the early history of the case, it may be useful to bear in mind that the discharge of calculous pyelitis often intermits, while that of tubercular disease is continuous. Besides this calculous suppuration is more protracted than tubercular, and it usually leaves the bladder healthy, while with tubercular disease this organ generally becomes involved.

Consequences.

The production of pus within the distended and attenuated kidney gives rise to further consequences. The obstruction, whether it be a stationary calculus or a stricture which has resulted from the temporary lodgment of one, may be complete and permanent, allowing no fluid to escape at any time; or it may present an obstruction which will only yield to extreme pressure, so that the contents of the cavity generally retained will escape at intervals, when the needful *vis a tergo* has accumulated; or it may be that the constriction never amounts to an absolute dam, but allows the contents of the cyst habitual though not free exit; finally, the stone may have gone on its way, and left no narrowing. The symptoms of the disease and the prospects of the patient vary materially with these circumstances. Next to an unobstructed channel, it is probably best that it should be completely closed. The impediment had better be quite, than nearly, insurmountable. If there is no outlet it may happen that the production of pus will after a time cease for want of room, the watery part subsequently disappearing, and the atrophied kidney collapsing upon putty-like matter, in which a stone may be imbedded, the whole forming a useless but perfectly quiescent and innocuous mass. Under less fortunate circumstances the imprisoned matter may make its way to the surface of the body, or may reach the bowel or peritoneum. Of such results I shall speak presently.

Occasional obsolescence.

When the obstruction is partial the secretion of urine is less completely arrested, and the kidney may fill and empty many times with successively increasing distension. The intermitting discharge of pus which happens in these cases, with intervals, often lasting for months, during which the urine is natural, and the patient, perhaps, apparently well, is very characteristic of the disease. Examples of this intermittence are afforded in the case of the old woman whose kidney formed a tumour, thought to be ovarian (referred to, page 743), and also by that of the tavern-keeper, about to be related.

Gives rise to protracted suppuration, with its usual consequences.

When the nature of the obstacle is such as to allow of a continuous, but not a free discharge, the disease exists in its most protracted form. There is not enough pressure upon the walls of the cyst to arrest secretion, while there is too much to allow of any contractile process. The suppuration may be profuse and long-continued, pure laudable pus being habitually passed with the urine, sometimes for years. In these cases the constitution is apt to suffer from the drain, and general lardaceous deposition to ensue. It may happen that other results of profuse suppuration follow. The patient may, with or without lardaceous intervention, fall into a hectic febrile state, succeeded by typhoid prostration.

The following case, which I brought before the Pathological Society, shortly after its occurrence, illustrates some of the points which have been mentioned, among others the occasional difficulty of diagnosis.

Discharge of pus with the urine for three months. Cessation and reappearance of discharge. Gradual sinking, with hectic symptoms. No conclusive evidence of calculi during life, but on post-mortem examination left kidney converted into a suppurating cyst, in which were minute stones. Stricture of ureter probably of calculous origin.

The subject of the following narrative was a tavern-keeper, forty-nine years of age, who died under my care in December, 1869 :—

He was said to have been of temperate habits, and in his youth was somewhat celebrated as an oar. He was apparently well until two years before death, when the urine began to deposit a white sediment, described as resembling pus. This was not attended with any pain, inconvenience, or obvious disturbance of health, and after about three months the urine resumed its natural appearance, which it continued to present until six months before death, when the pus reappeared and continued to pass in increasing quantities. He never had any frequency or pain in micturition, nor any symptoms referred to the bladder. No stones or gravel were ever consciously passed, nor had there ever been any pain referred to the course of either ureter. The urine was never known to be smoky or to present any appearance such as could be ascribed to the presence of blood. For six months he had had dull pain across the lumbar region, which affected both sides alike. For the same length of time he had lost flesh and failed in health, and latterly the complexion was observed as yellowish.

When I first saw him, about ten days before death, he was febrile and prostrate. The complexion was yellowish and the features sharp. There were frequent night-sweats. He was excited in manner, and at night had been occasionally delirious. The pulse was quick and feeble (96—100), there was much thirst, the tongue and lips were dry. He vomited frequently, and there was total loss of appetite.

Latterly he had had diarrhœa. The urine was mixed with 'laudable' pus, which after subsidence occupied about a quarter of its bulk. Under the microscope the sediment appeared to consist entirely of well-formed pus-corpuscles. The supernatant fluid was acid, and had a specific gravity of 1012. After the subsidence of the pus-globules it contained albumen, which coagulated to one-fourth.

Under the circumstances it was sufficiently clear that the kidney was the source of the suppuration, and the only doubt to be solved was whether the kidney was the subject of tubercular disease or was the seat of suppuration connected with stone. The lungs were carefully examined for evidence of tubercle with a negative result, but at the same time there was a total absence of any symptoms connected with the passage or lodgment of calculi.

Morphia, strychnia, and ice were successfully applied to relieve the sickness, which was for a time the most pressing trouble; subsequently cinchona with small quantities of bicarbonate of potash and frequent fluid nourishment, with eight ounces of brandy daily, were given to counteract the rapidly increasing prostration. The pulse, however, increased in rate, the expression became haggard and worn, he was frequently delirious, and in this condition gradually sank.

In the doubt which existed as to the precise nature of the renal abscess, I was very desirous to make a *post-mortem* examination, but I was only permitted to take out the kidney, and that under peculiar and embarrassing circumstances.

The peritoneal cavity was natural. The left kidney was converted into a large cyst with very thin walls, which contained about a pint of purulent fluid. The cyst was lobulated externally, and internally divided into compartments; it still retained a kidney-like outline. The walls were almost simply membranous, small remains of renal structure being detected in them. The lining was smooth, very vascular, and had a creamy pus-producing surface. The upper two inches of the ureter were dilated to the thickness of the finger; beyond this was a tight constriction through which a probe would not pass, though the fluid contents of the cyst escaped scantily under pressure. The empty cyst weighed three and a quarter ounces. In the cavity were found about forty very minute black calculi, like poppy seeds, which together did not weigh half a grain; these consisted of oxalate of lime.

The right kidney could not be abstracted; it was of natural bulk, and, examined with the naked eye as far as the light of a candle would allow, it seemed healthy.

It was clear, from the *post-mortem* examination, that the oxalate of lime calculi had been at the root of the mischief. The small stones which were found in the cyst, though insufficient of themselves to produce the result, were enough to show the nature of the disease, and render it likely that a larger mass of the same kind had at some former period been impacted in the ureter, and on its escape had left behind it ulceration, which ultimately gave rise to the stricture to which the dilatation and destruction of the kidney were due. The total absence of any fact in the history pointing to the passage of calculi is not what would have been expected, but negative evidence of this nature is not always reliable. It has happened to me in other cases to fail to obtain any account of the passage of calculi, notwithstanding a strong probability that some had at some earlier date been passed.

Death appeared to have resulted in this case from the suppuration, either directly or, what appeared likely from the symptoms—diarrhœa, thirst, and vomiting—with the intervention of lardaceous disease. The inevitable incompleteness of the *post-mortem* examination, however, did not allow the organs to be searched for the confirmation of this view.

Calculous pyelitis seldom caused without retention of urine.

We have little clinical knowledge of calculous pyelitis existing apart from obstruction of the ureter by present stone or consequent stricture. The mere mechanical irritation of the calculus seldom seems enough by itself to keep up continued suppuration. Retention and decomposition of urine, impossible while the ureter is open, are necessary. It is sometimes found that after death, perhaps from some cause unconnected with renal disease, an attenuated kidney, the pelvis of which still bears traces of suppuration, has tightly contracted upon a stone, the pervious ureter having given exit to the once copious contents of the cyst. In such a case the wasting of the gland is sufficient record of past retention. The obstruction, however, has been overcome, probably by the passage of the occluding stone, the pus has escaped, the kidney has contracted, and though useless has ceased to be mischievous.

On Suppuration from Calculus Extending Beyond the Kidney.[1]

Pus originating in the pelvis in connection with a stone sometimes makes its way out of the kidney, and travels in various directions. This can only occur when the ureter is either completely closed or much obstructed. The pus may pierce the muscles of the back, and make its exit through the skin in that region. It may enter the psoas muscle and give rise to a psoas abscess, which scarcely differs from that which is so commonly associated with spinal disease. It may break into the peritoneum. It may, if belonging to the right kidney, ulcerate into the ascending or transverse colon or duodenum; if in the left into the descending colon. It has been known to traverse the diaphragm, and make its way out by the bronchial tubes; and lastly, it has been stated, though not on conclusive evidence, that urine and calculous matter have passed from the kidney into the stomach, and thence been rejected by vomiting. Of these events the most

Various directions of pus of calculous origin.

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[1] See also chapter on 'Perinephritis,' p. 669.

common are the discharge upon the loins and into the descending colon. Peritoneal rupture comes next in order of frequency. Penetration of the duodenum, transverse colon, and bronchial tubes is comparatively rare.

Calculous abscess opening superficially.

The opening of a calculous abscess superficially has been recorded by Howship, Brodie, and many other writers. Sometimes stones have made their way out by this route, and the patients recovered, but more often the slow and exhausting process has terminated fatally.

Dr. S. F. Simmons[1] records the case of a woman who passed seven small calculi, at intervals, from a sinus in the left loin, and Cheselden states that from three patients he removed stones 'which had made their way from the kidneys to the integuments, and there occasioned an imposthumation.' A calculous abscess usually occupies the lumbar region, and is apt to be mistaken for disease of the spine. A woman, twenty-six years of age, died in St. George's Hospital, under the care of the late Mr. Keate, with a lumbar abscess, which was thus misinterpreted by that careful and acute surgeon. It was found, however, after death, that the suppuration had proceeded from the left kidney, the outlet of which had become obstructed by several large calculi. Matter had collected in the pelvis, made its way backwards through the lumbar muscles, and penetrated to the skin in this region. The pus lay in considerable quantity around the kidney, and had worked its way upwards to the diaphragm, the complete penetration of which was only prevented by some adhesions, which had closed what would otherwise have been an open channel, conducting the renal pus into the pleural cavity.

An abscess connected with renal calculi may open in the groin, upon the front of the thigh, near the hip; or, as in the case about to be related, upon the gluteal region.[2]

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[1] *Phil. Trans.* 1774, p. 108.

[2] Rayer gives an instance where a calculous abscess opened both in the loin and upon the front of the thigh, *Maladies des Reins*, vol. iii. p. 285.

History of calculi. Sinus opening on the buttock. Peritonitis and pyæmia. Right kidney converted into a cyst which suppurated, and eventually burst into the peritoneal cavity.

The following case occurred in the practice of my friend Mr. Hulke, at the Middlesex Hospital, who has liberally placed his notes at my disposal.

A servant-girl, twenty years of age, of healthy appearance, became his patient on August 1, 1865.

Two years previously, after lifting a heavy weight, she was attacked with severe pain in the right hypochondrium and flank, which occasioned her confinement to bed for a fortnight. Some time afterwards she passed by the urethra two brown stones, each about the size of a horse-bean. Nine months before admission, after pain in the right hip resembling rheumatism, an abscess burst over the upper part of the sacro-iliac joint. This closed and re-opened several times, and at last led her to seek relief at the hospital.

When admitted the aperture of a sinus was found just above the posterior superior angle of the ilium on the right side; the sinus passed deeply under the muscles in the direction of the anterior superior spine. There was tenderness on deep pressure in the right flank.

The urine, which since the passage of the stones had been more or less cloudy, but had never, as far as was known, contained blood, caused some local irritation, as well as dragging pain in the lower part of the belly during micturition. Under the microscope it showed scaly epithelium and pus, but nothing which could be identified as renal.

In the doubt which necessarily existed as to the origin of the suppuration the patient was put under chloroform, and the sinus followed with a probe beyond the crest of the ilium under the quadratus lumborum muscle to the neighbourhood of the kidney.

Two days afterwards, rigors and sickness came on followed by abdominal pain, especially on the right side, a rapid and feeble pulse, sickness, and much heat of skin. The urine became lithatic, and was still found to contain pus-corpuscles. Under opium, ice, hydrocyanic acid, and poulticing, she temporarily improved, but afterwards lapsed into a condition of prostration, with much tympanites, a dry tongue, and an extremely quick pulse. and died on February 6, eleven days after the rigors which marked the beginning of the end.

On *post-mortem* examination the left pleura was found to be filled with purulent fluid, the serous surface being coated with soft lymph. The lung was collapsed, and contained in its substance many deposits of pus, the largest the size of a hazel nut. In the anterior mediastinum were small purulent depôts in contact with the pericardium. The interior of this membrane and the heart were natural.

The peritoneal cavity contained about twenty ounces of purulent fluid, the serous surface being coated with soft yellow lymph. This was particularly abundant about the liver. Firm fibrous adhesions attached the liver to the right kidney. This organ was found to have been converted into an irregular sacculated pouch, on the anterior surface of which, towards its upper end, was a small hole with shreddy edges, through which the contents of the cyst had entered the peritoneal cavity. The sac, in the walls of which scarcely any renal structure could be detected, contained purulent fluid and small irregular phosphatic fragments. The ureter was narrowed and surrounded by thickened fibrous tissue. A sinus led from the cavity of the kidney through the quadratus lumborum muscle into the opening on the loin. The left kidney was of about twice its natural size, the structure was natural.

The opening of a renal sinus upon the buttock is unusual, and, notwithstanding that the indications of renal disease were examined and weighed, it was not possible to solve the doubts which attended the origin of the pus until it was traced by the probe to the lumbar region.

The fatal perforation of the cyst-wall was far out of reach from the outside, and could only have had a very indirect connection with the surgical examination upon which it followed so closely. Possibly some strain or unusual movement may have given the fatal last touch to a rupture already all but complete. The peritonitis was the immediate result of the escape of the purulent contents of the cyst. The pyæmia, which as appeared from the state of the chest also existed, must probably be assigned to the suppurative peritonitis rather than directly to the renal disease.

It is worth observing that in this case, as in that of the tavern-keeper, related p. 936, the calculus which had caused the fatal stricture of the ureter had made its escape, so that at the time of death only fragments—minute, but not insignificant—remained as a record of past disease.

Protracted course and diagnosis of lumbar abscess of calculous origin.

With the cases which have been related it is unnecessary to dwell further upon the course and diagnosis of the calculous variety of lumbar abscess. The progress of the disease is usually excessively protracted. A scanty discharge has been known to flow for many years from an abscess of this nature. Once open, such sinuses appear to have little tendency to close, though in some cases the discharge has become insignificant. As to diagnosis it is probable that a careful consideration of the antecedents would in most instances suffice to suggest a calculous origin, a suggestion which would be confirmed by the absence of definite spinal symptoms.

Rupture into the peritoneum.

It is far less common for a calculous abscess to break into than behind the peritoneum. When this usually fatal accident happens it is where the kidney has been much dilated and the peritoneum tightly stretched over its front surface. I say *usually* fatal accident, for it is not impossible for the rupture to be so guarded by adhesions that no immediately evil consequences follow. An example of this is given in the case of Julia Broadbelt, page 946, in which a calculus made its way across the peritoneal cavity, from the right kidney into the colon. It more often happens, however, that such limitation is absent or incomplete, and the occurrence fatal, with the well-known symptoms of peritonitis in the acute form which is associated with perforation of the hollow viscera.

The following case occurred at St. George's Hospital:—

Obstruction of right ureter by calculi, sacculation of kidney, followed by suppuration in the cavity. Ulceration into peritoneum and fatal peritonitis.

Jane Barrett, a dressmaker, twenty-one years of age, was admitted under the care of Dr. Fuller on June 23, 1863. She complained of slight pain and tenderness in the hepatic region; the pulse was frequent, the tongue moist but brown. Her complexion was sallow, but her expression free from distress, and her manner hysterical. She was well-nourished, and her general aspect was not indicative of serious disease.

It was stated that she had been ill for a fortnight with nausea, frequent bilious vomiting, and confined bowels. A few days before admission she had screamed from a sudden attack of acute pain in the right hypochondrium; this, however, was of short duration, and had subsided by the time she was brought to the hospital.

On the morning of the 25th, she again screamed as if in acute pain, she had a rigor, and her countenance assumed a terrified and imploring expression. This was succeeded by symptoms of general peritonitis, under which she sank on the following day.

My personal knowledge of the case began with the post-mortem examination, which it was my duty to superintend.

The peritoneum contained a quantity of pus, which was particularly abundant about the right iliac fossa. The bowels were generally glued together with recent lymph mixed with pus. Pus was issuing from a ragged hole about as large as half-a-crown, just below the liver. This proved to be in the front surface of the right kidney, which was distended by thick pus into a large sac, divided by septa, according to the position of the calyces, and lined by thin false membrane. The part of the wall which had given way was a sort of diverticulum from the pelvis. Intermixed with the pus within were many small calculous fragments of a friable consistence. Others were lodged in the ureter, closing it so nearly that there was much difficulty in pushing a probe through the tube.

The pleura contained bloody fluid, and there was a peculiar gangrenous-looking ulceration at the root of one lung, exposing, but not laying open, the great vessels in that situation.

A case is related by Rayer,[1] upon the authority of Dupuytren, in which a somewhat similar accident was slowly fatal. A perforation of the upper part of the left ureter, consequent upon the lodgment of a large stone, led to extravasation of urine, and the subsequent formation of many partially circumscribed abscesses among and behind the bowels. Some of these communicated by small holes with the intestinal cavity. One lying in the left renal region was punctured during life.

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[1] Rayer, *Maladies des Reins*, vol. iii. p. 309.

Discharge into the bowels;

A calculous abscess in the right kidney may open into the duodenum. It has been known to cross the peritoneal cavity, as already stated, and find an exit in the right extremity of the transverse colon. A stone in the left kidney, or matter connected therewith, frequently makes its way into the descending colon, where it lies in close relation with the diseased organ. This is by far the most common track by which a renal calculus reaches the intestinal canal. It is a rare event for a calculous abscess to reach any part of the bowels which are separated from the kidney by the peritoneum, since perforation of the serous cavity is usually, though not invariably, the last injury inflicted by a renal concretion.

into the duodenum;

Taking the bowels in their order of position, I may first refer to an instance related by Rayer, in which an abscess of this nature penetrated the duodenum.[1]

A woman who had long had hæmaturia, with other signs of renal calculus, presented, after an increase of pain, a tender fluctuating swelling on the right of the umbilicus. This was succeeded by the repeated vomiting of fœtid alkaline matter, the taste of which was a source of distress to the patient, with coincident diminution in the size of the tumour. The legs then became dropsical, and the patient sank three weeks after the commencement of the vomiting. It was found that the right ureter was obstructed by calculi, and the kidney dilated, sacculated, and full of pus. The interior of the sac communicated with that of the duodenum both directly and indirectly; directly by means of a fistulous channel which passed behind the peritoneum from the lower part of the renal cavity into the duodenum; indirectly by means of an abscess, circumscribed by peritoneal adhesions, which had openings both into the renal cavity and into that of the duodenum. The inferior vena cava was obstructed by coagulum, which had probably occasioned the œdema of legs which came on before death.

I will place next the case of a calculus which traversed into the transverse colon;

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[1] *Maladies des Reins*, vol. iii. p. 294; also plate xx.

the peritoneal cavity under the protection of adhesions, and made its exit by the transverse colon.

Sacculation of right kidney from calculi, one of which made its way into the transverse colon, and thence escaped. Subsequent peritonitis.

Julia Broadbelt, thirty-one years of age, came into St. George's Hospital, under the care of Dr. Nairne, in the year 1852. She had been attacked a week before with pain in the loins and belly, and 'a stoppage in the ureter.' A rounded tumour, dull on percussion, could be felt on the right side of the abdomen, and the urine was found to contain pus, not enough, however, to make it alkaline. She was feverish, and had night-sweats. She left the hospital in improved health, but came back eight months after her first admission, bringing a small stone which she said had passed from the bowel with a sensation of 'bearing down' during an attack of diarrhœa. This was found to consist of uric acid and oxalate of lime. Its escape was followed by much improvement in health, which, however, was interrupted by occasional attacks of bilious vomiting.

Three weeks before her second admission she was seized with pain in the right side of the belly, sickness, pains in the head and limbs, and general illness. When seen she was haggard, worn, and emaciated. Her chief complaint was of pain in the right hypochondrium, which was hard and tender. She lay on her back with the knees drawn up, and the countenance anxious. The urine contained pus, but not to the same extent as previously. It held a trace only of albumen. She had cough with muco-purulent expectoration. Latterly she had night-sweats, severe diarrhœa, and a general hectic condition, under which she sank.

Extensive adhesions were found between the stomach, transverse colon, liver, and abdominal parietes. The colon at its flexure in the right hypochondrium was also attached to the upper and anterior part of the right kidney. The kidney itself was dilated into a pouch, the cavity of which communicated with the interior of the colon, at the spot mentioned, by an ulcerated opening which would admit of the passage of a quill. In the dilated cavity of the kidney were three calculi, each about twice the size of a pea. The edges of the opening were thickened, and the lining of the colon in the vicinity congested. The left kidney appeared natural, as also did the thoracic and other organs.

The sequence of events is very clearly seen: the formation of calculi and sacculation of the kidney; subsequently suppuration in the cavity and ulceration into the bowel, with temporary relief; finally peritonitis in the neighbourhood of the opening, possibly from an accidental separation of the adhesions, and escape into the peritoneum of some of the contents of the cyst.

into the descending colon.

Penetration of the descending colon by a calculous abscess is a common and probably not always an unfavourable event. The apposition of the descending colon and the left kidney, behind the peritoneum, gives facilities for this mode of exit. Instances of this occurrence are frequently related in books and illustrated by preparations.

In St. Bartholomew's Hospital is a kidney which has become sacculated in consequence of the lodgment of a calculus in the mouth of the ureter. Two ulcerated openings connect the cavity of the pelvis with that of the descending colon. During life there had been frequent attacks of pain in the loins, which had been as often relieved by the escape of pus from the bowels.

A singular connection between the left kidney and the bowel is illustrated by a preparation at St. Thomas's Hospital. The pelvis has become dilated from calculous obstruction, and has become the seat of suppuration. The pus made its way through the anterior wall of the dilated pelvis, and formed a circumscribed abscess between the kidney and the descending colon, into which it opened.

Perforation of the stomach by a renal calculus.

I am not acquainted with any unequivocal case in which a renal calculus has caused a perforation of the stomach. Vomiting of urine is a not unknown occurrence, but the subjects of the phenomenon are usually hysterical women, and the route from the kidney to the stomach more circuitous than they would have believed.[1]

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[1] Dr. Sclater, of Philadelphia, relates, in the *Trans. of the College of Physicians* of that city (vol. i. part. i. p. 96), the case of a young woman with retention of urine. Whenever the catheter was withheld, urine, often mixed with urinary gravel, was either vomited or passed from the bowel or discharged from the navel. The patient died apparently of ulceration of the stomach—a condition continually associated with hysteria. The kidneys and bladder

Rayer gives a striking instance of a deception of this nature (vol. iii. p. 290).

It is related in the 'Philosophical Transactions' that in the year 1690 a lady who was under treatment for vomiting and *dolor nephriticus*, died during a paroxysm of sickness. After death a calculus, weighing eight drachms, was found in the pyloric end of the stomach. A figure of the stone which is given has an unmistakably renal outline, with the smooth point for the end of the ureter, and the rough notched back corresponding to the calyces. The figure at page 875 nearly suits it in size and shape. A stone of the same substance was found in the left kidney. The state of the right kidney from which the stone had presumably travelled is not mentioned, nor have we any further particulars of the state of the organs save that stones were found in the gall-bladder. We may perhaps fairly conclude that the gastric stone was of renal origin, but must remain in doubt as to how it reached the place where it was found.[1]

Perforation of the bronchial tubes.

As often happens with perinephritic abscess, let it depend on what it may, matter of calculous origin may make its way through or behind the diaphragm, and thence into the bronchial tubes. In the case of Jane Barrett (page 943), the root of the lung was deeply excavated, probably by the intrusion of pus connected with a renal calculus. It appears, either because the matter rises along the spinal muscles and thence enters the root of the lung without crossing the pleural cavity, or because the pleural cavity becomes under the process of perforation securely guarded by adhesions, that the bronchial tubes rather than the serous interspace become the recipients of pus entering the thorax from below. The passage of matter from below to above the diaphragm is perhaps most familiar in connection with hepatic abscess. As well displaying the details of the process, as connected with the kidney, I shall venture to introduce an instance from Rayer.

were found to be substantially natural. Under these circumstances perhaps few persons in the present day will be inclined to adopt the explanation suggested by the author that the urine reached the stomach by a retrograde course through the lymphatics. The case was probably one of hysterical deception.

[1] *Abridgement of the Phil. Trans.* vol. iii. part i. p. 160.

Renal calculus with pyelitis and discharge of pus by the urethra. Sudden and abundant purulent expectoration coincident with diminution of the pus in the urine. Post-mortem examination, showing a communication between the dilated kidney and the bronchial tubes.

The subject of the following narrative was a locksmith named Alexandre Fleury, who died at the age of thirty-nine, in La Charité, under the care of M. Rayer.[1]

At the age of twenty-one, Fleury had had two stones extracted by lithotomy. The operation was followed by eleven years of good health, which were terminated by a nephritic attack in the left side, and the spontaneous passage of a small stone. This, again, was followed by an interval of health, which lasted six years. After this he became subject to severe pain in the region of the left kidney and ureter, which he bore for seven months, and then sought relief in the hospital, into which he was admitted on May 25, 1839.

He was then thin, weak, and of a pale, yellowish complexion. The pain, increased by pressure and movement, was exactly limited to the locality of the left kidney. It came on in paroxysms, but was not entirely absent in the intervals. No swelling could be felt. The urine, which was acid, was passed with frequency, and contained pus to about a twentieth of its bulk. Subcrepitant râles were audible at the lower and back part of the left lung.

On the 30th there was an aggravation of the pain, the paroxysms being very severe, intermitting incompletely, and involving the whole left side of the belly, which was tender on pressure. The breathing was slightly embarrassed, and the countenance expressive of distress. The bowels were loose, the skin hot, the pulse rapid. Next day, after increased distress with the breathing, restlessness, and frequent cough, he spat up a large quantity of fœtid matter. Again, on June 2, 250 grammes (about nine ounces) of pus, such as might have come from a 'cold abscess,' were expectorated after a violent fit of coughing. The skin was now more yellow. The patient lay on his right side, the left side of the chest being painful; on auscultation the only signs of disease were large moist sounds at the lower and hinder part of the left lung, near the inferior angle of the scapula. Purulent sputa, slightly tinted with bile, were continually spat up, gushes of pus, distinct from these sputa, coming up after violent fits of cough. On the following day the urine contained little or no pus. The abdomen was tympanitic. Gurgling and cavernous sounds were heard at the base of the left lung. The facts related led to a conclusion that an abscess of the kidney had traversed the diaphragm, and was discharging by the bronchial tubes.

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[1] *Maladies des Reins*, vol. iii. p. 313.

For a time no material change occurred in the special symptoms, the general state of the patient somewhat mending. The expectoration remained fœtid. On the 15th the diarrhœa became more profuse, the motions passing involuntarily, the tongue became brown, swallowing difficult, and the voice nearly inaudible. Two days later a great quantity of pus was again suddenly coughed up, after which the patient sank and died on the 18th. It seemed that the abscess had emptied itself at intervals into the bronchial tubes, discharging slightly at other times. The pus in the urine had increased as the expectoration diminished, and conversely diminished as the discharge by the bronchia increased. On *post-mortem* examination it was seen that the diaphragm, upper ends of the psoas muscles, stomach, spleen, and superior part of the left kidney were bound together by old adhesions. Before the organs were displaced air was blown into the left ureter, and found to bubble into the bronchial tubes. The pelvis of the left kidney was dilated, thickened, and filled by a rough calculus, which sent branches into all the calyces. The renal substance was atrophied to such an extent that the prolongations of the stone and the pus about them were in contact with the capsule. At the summit of the kidney one of the dilatations was opened by a small hole with rounded edges, which led through the capsule from the cavity of the organ to a small sub-diaphragmatic excavation, which itself was in continuity with a channel which passed through the diaphragm, at the edge of the central tendon, perforated the base of the lung, and entered one of the bronchial tubes. The lower part of the lung was indurated, the rest loaded with serum. A small circumscribed abscess, independent of that which has been described, lay between the kidney and the psoas muscle. The ureter was dilated, to the thickness of the finger, as far as its vesical termination. The right kidney was natural, except that it contained an old cicatrix; it seemed to have been the source of all the urine which passed, while from the left kidney proceeded all the pus.

Suppression of Urine from Calculi.

Writers of the ante-pathological era speak of paralysis of the kidney as if that gland were apt, like a discontented workman, to strike though still able to work; but it has been shown in another part of this volume that though the secretion of urine may be temporarily, or even finally arrested by constitutional causes, yet that it never stops altogether as the result of renal disease, unless the outlets are blocked. This closure may be by growths or clots, but in by far the larger proportion of cases it is due to calculi, or to the injury calculi have inflicted.

An obstruction to cause suppression must occur simultaneously in connection with both kidneys, or else, should it refer only to one, the other must have been destroyed by antecedent disease.

Such renal calculi as are of constitutional origin, uric acid, oxalate of lime and cystine, are apt to occur in both kidneys, either at the same time or successively.

When both kidneys are simultaneously affected the stones are often so far symmetrical that both ureters are closed in the same manner, and to the same extent.

The following case, which occurred at St. George's Hospital, is an illustration of this condition:—

Suppression of urine consequent upon uric acid calculi symmetrically placed in both kidneys.

Dr. Fuller, under whose care the patient was, was responsible for the clinical details, I for the *post-mortem* examination.

Charles Richardson, forty-nine years of age, a well-developed, healthy-looking countryman, came into the hospital on December 5, 1862. Two years before he had been squeezed by a horse against the side of a stall, and had afterwards had pain in the loins, and passed bloody urine. With this exception he had had uninterrupted health from childhood until the present attack. This began, without apparent cause, four days before his admission, with severe pain in the loins and suppression of urine. After twenty-four hours a considerable quantity of urine was voided, and the pain ceased. From that time until he came under Dr. Fuller's care at the hóspital no more urine was passed. He had no pain in the loins, no headache, nausea, nor any sign of general derangement, and applied for admission, not because he felt ill, but because he thought 'it could not be all right.'

On admission he had passed no water for three days, but his complexion was ruddy, and his aspect that of health. The skin was cool and moist, the pulse quiet and regular, the bowels open, the tongue clean, and the appetite good. A catheter was passed into the bladder, but nothing found. Warm baths, fomentations, and diuretics were used, but no urine was voided until the evening of the 6th (the day after admission), when he passed about two ounces, very pale, acid, and slightly albuminous. On the 7th and 8th he passed urine in about the same quantity and of the same character. The bowels acted once daily; the motions were natural in colour, and though not quite formed were not fluid. Up to this time he had retained the aspect of health, had eaten and slept well, and been quite free from pain, but on the morning of the 9th he began to suffer from uneasiness across the loins, his tongue became coated, and himself dejected. In other respects he was much the same: he voided from two to three ounces of pale, acid, albuminous urine daily; his intellect remained unimpaired, and there was no drowsiness. On the 10th he passed about three ounces of urine, but he vomited at intervals during the day, was very restless, and did not sleep at night. On the 11th his aspect was entirely changed; his face had shrunk, his expression had become anxious, and he looked careworn and much older. The same quantity of urine had been voided as on the previous day, but the pulse had risen to 108, the tongue had become furred and rather dry, and he complained of severe pain in the loins and in the pubic region. Dry-cupping was employed on the loins, followed by turpentine stupes; poppy fomentations were applied to the lower part of the abdomen, and opium and gin were given internally, but no relief was obtained. On the 12th thirteen ounces of urine were passed, but he was more shrunken and altered in appearance, the bowels were confined, and vomiting was more frequent. In the evening the pulse began to intermit, and the breathing became laboured. On the 13th, while sitting up in bed, talking to his wife, he suddenly fell back on his pillow, and in two or three minutes was dead.

The body was that of a vigorous, muscular man.

The left kidney was enlarged by dilatation to twice its natural size. Adapted to the outlet of the pelvis was a triangular calculus, which weighed 120 grains. This lay with the apex projecting downwards into the upper end of the ureter, which had been worn by long friction to fit accurately, but without impaction. The stone was so adapted as to form a nearly water-tight plug, though it could without force be lifted from its position (*see* Figs. 3 and 4). The structure of the kidney was extremely congested, and contained many small cysts.

The right kidney was equally dilated by accumulation of urine in the pelvis, and it contained a calculus, which in shape and position was almost the facsimile of that in the left. It weighed ninety-eight grains. The glandular structure of this kidney was healthy, but in every other respect the description of the left kidney and of the calculus it contained will apply to the calculus and kidney on the right side (*see* Figs. 1 and 2). The conical points of the calculi, which fitted with such fatal accuracy, yet fitted so easily that their own weight would have sufficed, were the body inverted, to have displaced them. The ureters were congested, but elsewhere unobstructed. The annexed woodcut shows the position and actual size of the stones. One which was cut through was found to consist of uric acid.

There was little else to mention in the *post-mortem* appearances. The costal cartilages were more than usually ossified. The pleural cavities contained a small quantity of blood-stained fluid. At the apex of the left lung was an irregular fibrous cicatrix. The pericardium contained a little serous fluid. The heart was flabby, uncontracted, and occupied by large elastic fibrinous coagula.[1] The mitral valve was slightly atheromatous. This case well illustrates the symmetrical tendency and the fatal adaptability of uric acid calculi.

Total suppression of urine dependent upon obstruction by stones of the left kidney and the right ureter.

An exceedingly fat man, who weighed twenty-three stone, had frequently passed small calculi with renal colic always on

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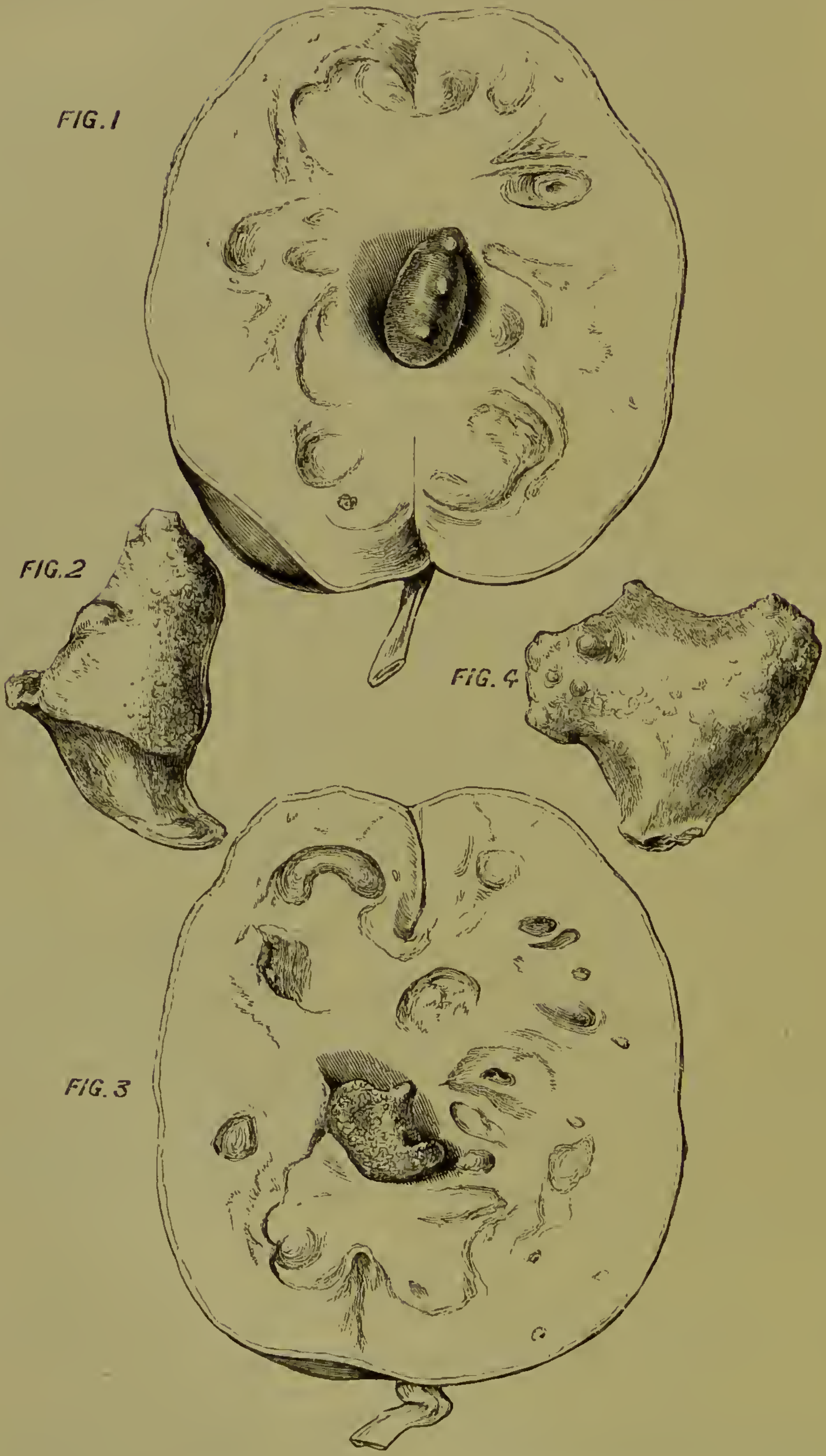
[1] This case is related by Dr. Fuller in vol. xiv. of the *Path. Trans.*



Kidneys and calculi in case of suppression of urine. Figs. 2 and 4 show the actual size of the stones.

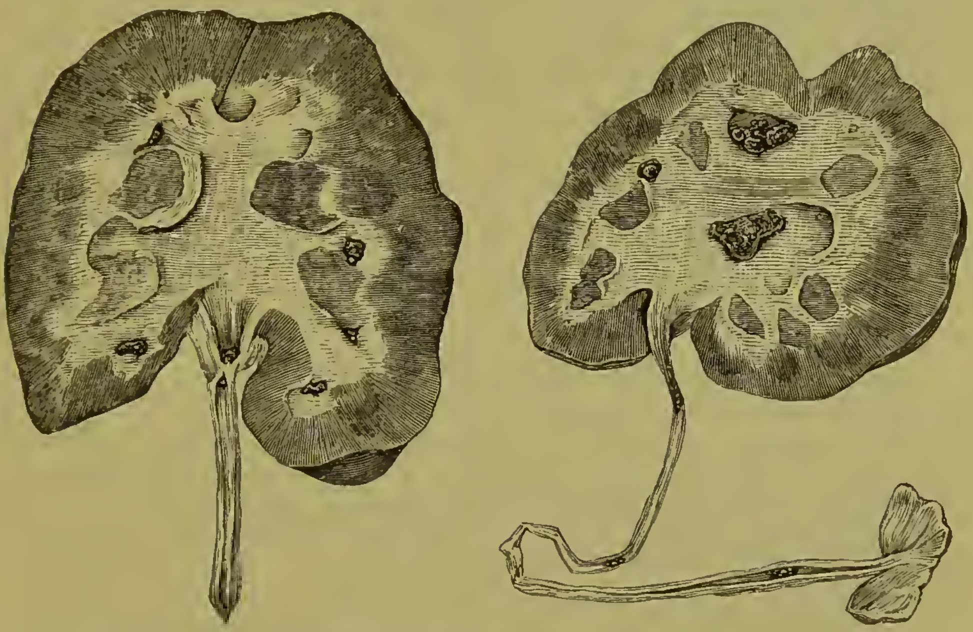
the right side; he had more than once, as he stated, had suppression of urine for two days. He had consulted me on a former occasion (in July 1881), and taken with advantage potash, lithia, and digitalis.

The last attack began in this wise:—Being in apparent health on August 21, 1882, he went from his house in Chelsea to the City, where, at 11 A.M., he was seized with an urgent and rather painful desire to make water. He passed a small quantity which, as far as he could observe, was natural. From this time he passed no more. On the evening of the 23rd Mr. Keen, of Chelsea, was called to him; he had slight pain along the course of the left ureter from the renal region to the groin, had been sleepless, but had eaten as usual, was not otherwise disturbed in health, and would not have sought advice but that the absence of urine caused apprehension. An ordinary, and then a long, catheter was passed, and the bladder ascertained to be empty. On August 25 I saw him with Mr. Keen. The patient was then up and dressed, free from pain, tranquil in mind, and looked and felt as if there were little the matter. No tumour or tenderness could be detected in the abdomen or back, but the amount of fat made negative evidence of this sort of little value. The legs were slightly œdematous, which was ostensibly accounted for by a slight mitral systolic murmur which existed. The tongue was coated and somewhat tremulous, the pulse soft, 80, the temperature in the mouth, 96°. A catheter was again passed, and the bladder found to be absolutely empty. I could not doubt but that the suppression was the result of mechanical obstruction, that it was by calculi, and that the latest and threatening stoppage was in the left kidney, the right probably having been blocked as the result of some preceding attack. A purge of calomel and colocynth was ordered, partly because the bowels had been inactive, and partly in the hope of helping on the obstruction by the general abdominal commotion. A digitalis poultice was applied to the belly, and three drachms of infusion of digitalis, ten grains of nitre, and thirty of citrate of potash given every four hours. He also had some gin, and a drink of cream of tartar. But the effects were negative. On the morning of the 27th I learned that until this date there had been little change; he had slept well, and somewhat heavily, but there had been no sign of coma, or somnolence by day. There had been no convulsion or even twitching. He had once or twice been sick after food, but not otherwise. He was still able to walk about—he had been advised to do so in the hope that change of position might shift the stone or expedite its course. But no drop of water had been passed. I had previously hinted at the possibility of surgical relief; and I now secured the services of my colleague, Mr. Bennett, to open the pelvis of the left kidney by incision through the loin, and arranged that, with the concurrence of Mr. Keen and the patient, the operation should be performed this afternoon. This was designed, not so much to remove the stone, though this might have proved an incidental advantage, as to afford an exit to the urine from the left pelvis. But scarcely had these arrangements been completed when I received intelligence of the death of the patient. On getting up on the morning of the 27th the pulse suddenly fell from 72, which had been its previous rate, to 48, without becoming irregular or otherwise unnatural in character. This was succeeded by repeated attacks of faintness, which lasted off and on for half an hour, at the end of which time he suddenly expired, sensible to the last, not having had in the course of the attack any nervous or mental disturbance. The time from the last discharge of urine to death was half-an-hour short of six days.

As an operation had been definitely planned, the *post-mortem* examination was of more than ordinary interest.

The right kidney was of about its normal size externally. On laying it open the pelvis was a good deal dilated, though not distended, and the cortical bulk correspondingly diminished. There was but little urine in the cavity. A large calculus lay in the upper part of the infundibulum or overhung it from one of the calyces, but was not so placed as to block the outlet, and there were several smaller stones in the calyces above. The ureter was absolutely impervious, partly by two old strictures, and partly by an accumulation of small stones and gravel on their approach from within. The narrower stricture was about three-quarters of an inch from the bladder, and was impassable by probe or bristle until in manipulation much of the gravel was dislodged. It was then found that the stoppage was made complete only by this accumulation. It must be noted that when the drawing was made, which is repeated in the woodcut, much of the gravel had fallen out; what is left, however, is accurately represented, and is enough to explain the condition. The strictures of the ureter were of old date, and it is probable that this kidney may have been thus blocked for a considerable time.

The left kidney was considerably swollen, its increase of external bulk being due to an accumulation of urine in the pelvis, which was guessed at two or three ounces. Where the pelvis narrows into the ureter a small elongated calculus was wedged so tightly that not a drop of water could have passed. The stone was pear-shaped, the narrow end fitting into the top of the ureter, the upper and broader part expanding into the bottom of the infundibulum, and preventing its further progress. The condition is well represented in the woodcut. The ureter below was natural. The pelvis of the kidney was somewhat dilated; a few small calculi were lodged in the calyces; the substance of the gland was fairly natural.



Kidneys from case of calculous suppression. A stone is tightly wedged in the left infundibulum, while the right ureter is stopped partly by old stricture and partly by small stones. Calculi are seen in the calyces of both kidneys, a large one in the right overhanging the mouth of the ureter.

Some of the calculi, which were chemically examined, proved to be composed of uric acid.

The lungs were somewhat congested. The left ventricle of the heart was absolutely uncontracted, the mitral valve thickened at the edges to a very trifling extent, not enough, as it seemed, to interfere with its action or account for the murmur. The ventricles contained large decolorised clots, but the blood was generally uncoagulated, viscid, and redder than usual.

This case is a typical example of calculous suppression. The suppression was absolute, and it is worth noting that it caused death just under six days. The absence of convulsion, somnolence, and the common signs of nervous disturbance is worth noting. Death was by asthenia, as in many other cases of the same kind. But for the fact that the left ventricle was found to be entirely uncontracted, it might have been supposed that the digitalis had contributed to the fatal syncope. It is to be regretted that the operation which had been designed was anticipated by death; it was, however, a clear duty to give the patient the fullest chance from remedies that in other cases had proved successful before subjecting him to a hazardous and experimental measure. I had made some trials on the dead body as to the practicability of reaching the pelvis from behind with the aspirator; the main danger proved to be in the depth of the puncture; in one case the pelvis was transfixed, an accident which, were it distended, might have led to the extravasation of urine into the peritoneum. The surer method was clearly to dissect from the loin. Had this been done, as it would have been done had this patient lived a few hours longer, there can be no doubt that, had he survived the operation, he would have been cured, at least for the time, of his disease. The suppression would probably have ceased with the opening of the cavity, and beyond this, as had been hopefully anticipated, the stone could easily have been drawn out from the infundibulum.

When the kidneys are successively disabled by calculous disease suppression occurs only on the incapacitation of the second. One ureter may, either by impacted stone or consequent stricture, become permanently closed, and the kidney sacculated, and for purposes of secretion practically non-existent, but yet no serious consequences may result, unless in process of time calculi be formed also in the second kidney, which now does all the work, and one, by evil chance, slips into and plugs its outlet. The obstruction which now results will cause suppression of urine, and will, if not speedily dislodged, be necessarily fatal.

I will relate two cases in point.

Total suppression of urine, fatal in four and a-half days. Left kidney recently occluded by a calculus; the right destroyed by ancient pyelitis, probably of calculous origin.

On March 7, 1874, I was called by Mr. Tatham, of Poplar, to see a lady who had passed no urine for four days. She was forty-six years old, married, but childless.

It appeared that she had long been subject to urinary troubles, which comprised frequency of micturition, the passage of gravel, though never of calculi, and more than once of blood. About two years before, after walking, she had a sensation of something having moved or burst in the left side of the belly, immediately followed by vomiting and diarrhœa. Afterwards she remained conscious of a fulness in this region, and subject to occasional attacks of vomiting.

Her general health, however, did not materially suffer until March 3, four days before I was called, when, after driving to Victoria Park, a distance of two miles, walking about there, and driving back again, she sat down somewhat wearily and went to sleep. She awoke feeling ill, saying she did not know what had come over her. She could not take her tea, felt sick, vomited twice, shivered, and had a pain chiefly referred to the lower part of the spine, which felt to open and shut. No water was passed from this time, but the absence of this excretion did not attract notice, until it was made the subject of inquiry by Mr. Tatham, on the following day. Before the attack the urine had been pale, apparently sufficient, and passed with some frequency.

The feeling of illness, nausea, and loathing of food continued, and dull pain came on in the left hypogastric and inguinal regions, which extended into the left thigh. The bowels became irritable, acting frequently with little result; and the next day, the absence of urine attracting notice, she was put into a warm bath once and again, with no result, excepting some increase of the dull pain in the left abdominal region.

On the 6th a catheter was passed, but only a drop of pale urine withdrawn within the tube of the instrument, just enough to show that it had entered the bladder.

When I saw her on the 7th she had a pale face, a cool skin, a restless manner, and a prostrate look. She continually sat up in bed to relieve the nausea, and then sank back, with an opened mouth, and an aspect of indefinite distress, into a noiseless slumber or doze, always of short duration, since she roused at the least word or touch. The pupils were slightly dilated. She readily and sensibly responded to questions, and supplied many of the particulars which have already been stated. She loathed food, often made efforts to vomit, and had frequent attempts at action of the bowels, which resulted only in the passage of minute quantities of semi-liquid fæces. The eyelids were puffy, but there was no other trace of œdema.

She complained of dull pain, and had much intolerance of pressure over the left side of the abdomen, between the edge of the thorax and the level of the anterior superior spine of the ilium. Between these limits a hard tense mass could be felt, which could be traced from within about an inch of the median line to the lumbar region. Towards the middle of the body it was less superficial than in the flank, and its shape, position, and connections distinctly pointed it out as an enlargement of the left kidney. No fluctuation could be made out.

Besides the pain in the region of this swelling, there was some of a dull character across the lower part of the back and in both loins. There was not and had not been any pain which could be assigned to the ureter.

The vesical region was depressed and resonant. The tongue was moist, white, and tremulous—there was no tremor elsewhere. The pulse numbered 128; it was feeble, rather jerking, and not quite regular. A faint systolic murmur was heard at the apex of the heart.

It was not possible to doubt that the suppression was mechanical; and almost equally certain, considering the history of gravel and the absence of any other disease likely to lead to closure of the ureter, that stone was the obstruction. The nature and position of the pain indicated that the impaction was pelvic rather than uretral; and having regard to the palpable differences in the bulk of the kidneys, I ventured to predict that one kidney would be found to have been obliterated by antecedent calculous disease, while the other, the sole working gland, had become suddenly incapacitated by the wedging of a stone in its outlet.

The prostration of the patient forbade the more active measures which her condition suggested. The feasibility of reaching the pelvis of the left kidney with an aspirator was discussed. The position of this organ immediately beneath the abdominal wall as evident to touch, would have made such an attempt less unsafe and less uncertain than could often happen. On the other hand, though it was presumed from the position of the pain and tenderness that this organ was the seat of the obstruction, yet it was not possible to be sure that the contrary was not the fact; that the swollen kidney was dilated of old and practically useless, while the recent obstruction had occurred in the smaller organ, which was not to be felt. On account of this element of doubt, as well as by reason of her extreme weakness, the project was abandoned. Her evidently loosening hold of life also prevented the inversion of the body, which was discussed, and otherwise would have been urged, in the hope of displacing the stone. As it was, we contented ourselves with advising that the posture should be changed from the supine to the prone and otherwise variously, and that digitalis should be given internally, and applied as a poultice to a convenient tract of skin.

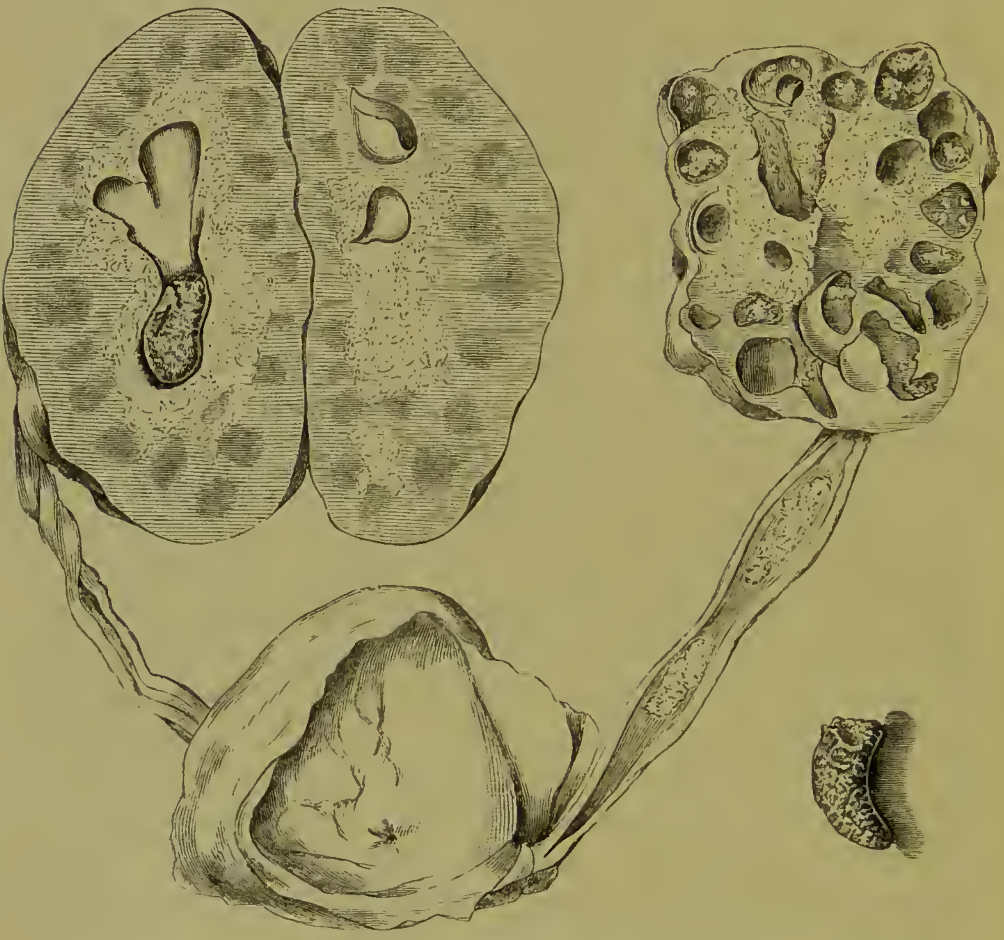
These measures, however, had no result. At midnight she had an attack of cardiac distress, which passed off under stimulants. She remained sensible and restless until five o'clock on the following morning, when she expired while supported in a sitting posture. The suppression, which was total, had lasted 108 hours, or exactly four and a-half days.

Post-mortem Examination.—The left kidney was much enlarged, full and tense; it measured 6 inches vertically, 2¾ from side to side. On section about a couple of ounces of urine escaped from the pelvis, and the broader end of a calculus was exposed to view, the point of which was fixed, though not so firmly but that gentle force would remove it, in the lower part of the cavity, which narrows towards the ureter. The pelvis was dilated to about twice its natural capacity; its mucous membrane, as was that of the ureter, was uninjected, and in all respects natural.

The stone measured 1¼ inch in its longest extent; it had a somewhat crescentic shape, its lower horn being worn by friction to fit the mouth of the ureter, which it closed with the accuracy of a ground stopper. Where the stone was worn it displayed a surface evidently of uric acid; the part exposed in the pelvis was roughened by a thin phosphatic deposit.

The cortex of the kidney was increased to about double its natural bulk, chiefly by healthy hypertrophy; the tissue was pale and firm from slight tubal obstruction. The surface was smooth but somewhat lobulated—the capsules unadherent.

The right kidney was practically non-existent. It was transformed into a many-partitioned cyst, each cell of which communicated with the pelvis, all being distended with a fluent substance nearly resembling half-set plaster of Paris. About two ounces of this tenacious material escaped when the kidney was laid open. The microscope showed it to consist largely of minute oil-globules and shrivelled epithelial and puriform cells. It was evidently inspissated pus. No glandular structure was left.



Kidneys and ureter from case of calculous suppression. The left kidney, which is hypertrophied, has the infundibulum accurately plugged by a stone, which is separately shown. The right kidney is converted into a mere shell, and its ureter stopped by former disease, probably of the same kind.

The outer wall was thin, in many places to translucency, and the septa equally attenuated. The ureter was irregularly distended, and thickened in the greater part of its extent, and occupied by a material similar to that which occupied the kidney, but sufficiently hardened to crumble and break. The last half inch of the ureter, where it nears and traverses the wall of the bladder, was totally occluded. The smallest instrument failed to penetrate, nor could any channel be by any means discovered.

The bladder was empty but perfectly natural. Nothing about the other organs called for especial notice. The ventricles of the heart were entirely uncontracted, the mitral valves slightly thickened, everything else natural.

The nature of the disease as displayed after death exactly corresponded with the indications recognised during life.

The right kidney had been destroyed by pyelitis, no less certainly consequent on calculous disease because the offending stone no longer remained. As often happens, this had eventually escaped from the ureter, but had left behind it a stricture destructive to the channel. The patient was thus left practically with but one kidney; which, however, developed in proportion to its responsibilities, and fulfilled a double function in spite of a stone loosely sitting in its pelvic cavity. But this stone at last, with fateful perseverance, wore itself to accurate adaptation to the funnel-shaped mouth of the ureter, and then an unhappy jolt, or a series of them, wedged it into its position, and closed for ever the only urinary exit.

The accompanying woodcut displays the morbid anatomy of a case of this kind which occurred in the practice of Dr. Bagshawe, and was brought by him before the Pathological Society.[1]

The subject was a house painter, sixty-two years of age, who had never been known to suffer from stone, though he had had frequency of micturition, especially at night. He had repeatedly suffered from painter's colic, and some twenty years before his death had had an attack of general anasarca. Of late, with the exception of occasional dizziness, he esteemed himself well, until January 1865, when suppression of urine took place, and lasted for three days, with constipation. He was relieved after taking saline purgatives.

On February 11 he voided with difficulty about a cupful of urine of the colour of blood. Then suppression set in. At the end of four days he applied at the Western General Dispensary, and it was ascertained with the catheter that the bladder was empty. The patient had become drowsy, there was ptosis of one eyelid, and some nausea. The pulse was 84. Purgatives, emetics, and small doses of tincture of cantharides were given.

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[1] I have extracted the following particulars from the characteristic narrative in the *Path. Trans.* (vol. xvi. p. 176). The woodcut was copied from a drawing placed at my disposal by Dr. Bagshawe.

On the 19th (the eighth day) he first experienced a desire to make water, and was reported, though there was some reason to doubt the accuracy of the statement, to have passed half a pint of limpid urine.

On the ninth day Dr. Bagshawe, whose attention was then called to the case, found the patient, a robust man, propped up in bed, breathing hurriedly. His manner was anxious, he was very restless, no longer drowsy; there was great muscular debility and subsultus; the pupils were contracted. He answered questions readily, stating that he had a sensation of dizziness, and that he suffered from a heavy tensive feeling, not amounting to pain, in the situation of the right kidney. The pulse was very irregular—from 52 to 56; the heart's sounds were laboured, the tongue sticky and coated, the skin cold, clammy, and of a leaden hue, the abdomen tympanitic. He had retched and vomited on two or three occasions; there had been two unformed dark motions during the day.

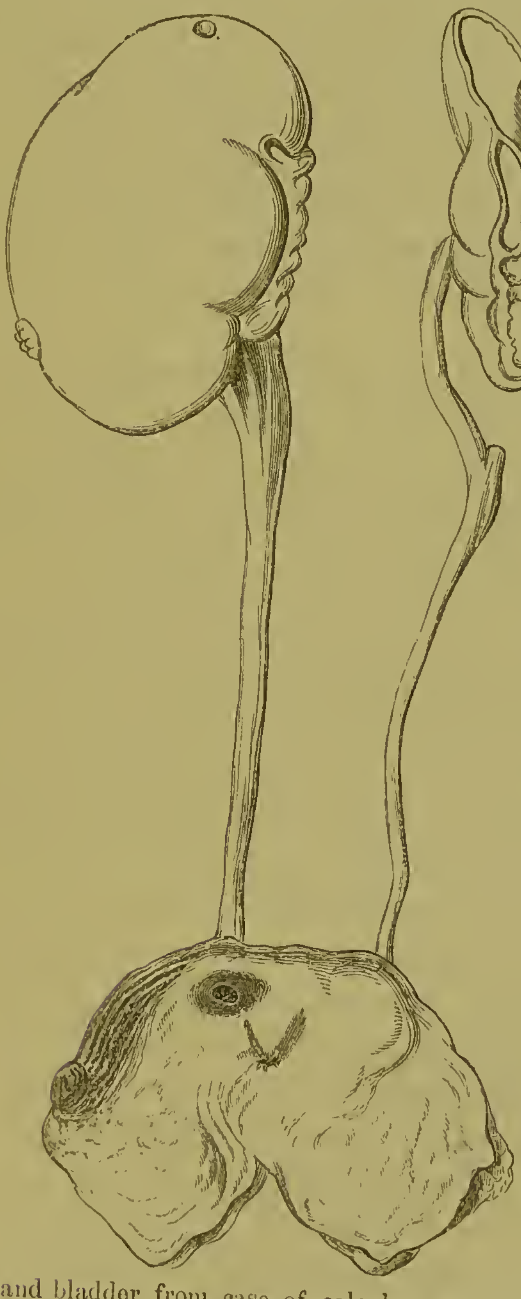
During the following night he slept at intervals, but his restlessness became extreme; he made frequent attempts to micturate, and voided only a few drops of blood. These symptoms increased, and he died quietly on the afternoon of the 21st, the tenth day of the attack, retaining his consciousness to the last.

On *post-mortem* examination it was found that the dura mater adhered firmly to the calvaria. The brain-substance was firm, of a dirty reddish colour. The lateral ventricles contained nearly an ounce of blood-stained fluid. The posterior and middle cerebral arteries were atheromatous.

The several serous cavities contained turbid fluid, which, with the exception of that in the pericardium, was of a reddish tint.

The blood was dark-coloured and fluid. The heart was healthy, the left ventricle contracted.

The left kidney presented the cystiform dilatation represented in the woodcut. In the tough fibrous bag, which was all that was left of the organ, no remnant of cortical or medullary structure was distinguishable by the naked eye. The smaller compartments contained clear fluid, while that in the two larger ones was thick and white, and resembled chalk mixture, an ounce and a half in quantity. This white fluid contained much cholesterine, numerous plates of which were seen under the microscope, together with amorphous granules of phosphate of lime. This kidney weighed two ounces. A small calculus was impacted in one calyx. The ureter was pervious through its whole course, excepting that no trace of its vesical orifice could be detected.



Kidneys and bladder from case of calculous suppression. The left kidney had been destroyed by former disease; the right has been recently stopped by a calculous plug at the vesical orifice of the ureter.

The right kidney was large and congested, its weight seven ounces. The capsule could be removed readily, leaving a smooth surface beneath. The structure had to the naked eye, excepting the presence of a few cysts, a generally healthy appearance. The pelvis and ureter were dilated and contained urine. The bladder was empty. The orifice of the right ureter was entirely blocked up by a dark-coloured plug, which had a concentrically laminated structure and contained crystalline fragments like uric acid. Under the mucous membrane of the bladder surrounding the orifice of the ureter there was sanguineous discolouration, and in another part of the bladder enough blood had been extravasated to form a clot of the size of a bean.

Usual position of calculous obstruction.

Obstruction from calculus usually occurs either at the funnel-shaped mouth of the ureter, or at its narrowed exit as it is traversing the coats of the bladder. If a calculus be small enough to enter the ureter, it will generally make its way to the vesical constriction. The points of danger are well illustrated in the several woodcuts. A case in many respects similar to Dr. Bagshawe's is related by Sir James Paget in the second volume of the 'Transactions' of the Clinical Society. A fat farmer, seventy-four years of age, passed first little and then no urine, and then lived through twenty-two days of suppression, which was total, except that on the thirteenth some urine escaped during sleep, and some more, pale and albuminous, was voided consciously, the total discharge amounting, as was thought, to about a pint. In the early days of the suppression there was a total absence of constitutional symptoms; then came pain in the left loin, a slight convulsion, frequent twitchings, nausea and drowsiness. The right kidney was dilated, its secreting structure reduced to a thin shell, and studded with cysts of various sizes. It contained half a pint of urinary fluid, but was probably useless as an agent of continued secretion. The left kidney was hypertrophied and gorged with blood, and its ureter blocked by a calculus two inches above the vesical orifice.

Instance of unusual endurance of suppression.

Sir James Paget attributes the unusual tolerance of the disease in this case partly to the advanced age of the patient, and the attendant slowness of the changes of nutrition, and partly to an insensitive disposition which naturally belonged to him.

Occasional small size and feeble hold of stone.

The smallness of a stone, which will cause fatal suppression in traversing the sole acting ureter, and the comparative ease with which after death it can often be displaced, may be a matter of surprise. One may be disappointed that the trifling amount of force necessary for its expulsion was not by some happy chance directed upon it during life. A stone under the weight of two grains has been known to be thus fatal.

Clinical aspect of calculous suppression.

Calculous suppression of urine associated so often with antecedent chronic changes and with the uric acid diathesis, belongs especially to the later periods of life, and to the male sex. The subjects are often described as robust or corpulent. Sir Henry Halford describes as 'paralysis of the kidney' a case almost certainly of this nature: the patient was a 'very corpulent, robust farmer, of about fifty-five years of age.'[1] Sir Henry adds that all the patients, five in number, who fell under his care with similar symptoms were 'fat corpulent men, between fifty and sixty years of age.' The subject of Sir James Paget's case, already referred to, was a fat farmer seventy-four years of age, older than most thus affected. The four patients, whose cases I have given in detail, varied in age from forty-six to sixty-two: three were of the male sex, one corpulent to monstrosity.

Age and personality of its subjects.

Dr. Roberts has placed upon record three cases of fatal calculous suppression, in all of which the subjects were of the male sex and of ages between forty and sixty-seven. The late Mr. Nunneley, of Leeds, recorded in the 'Pathological Transactions,' vol. xi. p. 145, an instance of suppression in a woman, whose age was thirty-three, calculi being found after death in both kidneys, but in both sex and age this occurrence was somewhat exceptional. I may mention as unusual in age and sex the case of a girl of seventeen, under my care as a hospital patient, in whom total suppression of urine for sixty-seven hours was relieved upon the passage of a quantity of uric acid. I have never ascertained the existence of calculous suppression in childhood, though a case is mentioned in the chapter on suppression in which it was presumed to have existed.

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[1] *Essays and Orations*, p. 31.

General course of the attack.

The course of the disease may be sufficiently gathered from the foregoing instances. An elderly, but apparently healthy man, who perhaps has at some former time had symptoms of gravel, finds, to his surprise, that he no longer needs to pass water. The cessation may take place in connection with an attack of sharp pain, indicative of a moving stone, or it may occur without warning.

For a time the patient seems little the worse. He is either entirely free from local uneasiness, or he has merely a dull pain or sense of weight in the loins, which does not trouble him much. His appetite is good, his general sensations are those of health, and at first little notice may be taken of the cessation. Presently the unusual nature of the occurrence, rather than any feeling of illness, causes him to seek medical advice. A catheter is passed, and the bladder found to be empty. The urine may remain totally absent, or small quantities from time to time, or now and then something approaching the amount of a natural urination, may be discharged. The urine, sometimes albuminous, is pale, of low specific gravity, and wanting in urea. According to the father of medicine,[1] ‘persons affected with calculus have very limpid urine.’ This is particularly the case when the renal outlet is obstructed. It has been elsewhere explained that there is a direct relation between poverty of urine and obstruction of the renal outlet. The longer uræmia is postponed, the greater the chance that the stone, should it be ‘viable,’ may complete its perilous course and allow the kidney to resume its functions. This it will do with extraordinary activity on removal of the obstacle. Should the obstruction fail to be removed, symptoms of uræmia will gradually appear, and ultimately prove fatal, the period at which this result happens being very variable, depending much upon whether the suppression be complete or incomplete. In the case presumably of calculous obstruction related by Sir H. Halford, of which he says that the others he saw were exact copies, the patient died in a state of stupefaction on the fourth day. The lady whom I saw with Mr. Tatham, in whom the obstruction was complete, died on the fifth day; the man seen with Mr. Keen, in whom it was likewise complete, died at the end of the sixth. Dr. Roberts relates a case in which death occurred on the sixth day, of complete suppression, but from the aqueous character of the urine there was reason to believe that some obstruction had existed for a longer period. In two other examples which the same physician was able to pursue to post-mortem examination, death occurred on the tenth day of suppression, which in each case was so far incomplete that in one fifty-four ounces (divided over three days), and in the other two ounces, of urine were passed. Dr. Bagshawe's patient, whose case has been related, died likewise on the tenth day, and in him also the period of suppression was interrupted by the passage on one occasion of a small quantity of urine. Richardson, whose case is related (page 951), died on the eleventh day; with him the suppression was so far incomplete that small quantities of urine, generally two or three ounces, were passed on seven of the eleven days. The woman already mentioned under the late Mr. Nunneley, survived twelve days of suppression, uninterrupted so far as was known; while the Hampshire farmer, under Mr. Paget (page 966), endured for twenty-two days suppression, which was intersected by the passage during one night, near the middle of the period, of about a pint of urine. It thus appears that poor as the secretion is which is yielded against pressure, and small as it may be in amount, it generally may be reckoned upon to prolong life. It is possible that in many cases of incomplete obstruction, more urine has escaped than has been observed. The

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[1] Hippocrates, *On Airs, Waters, and Places*, chap. ix.

Duration of suppression

results of obstruction may, however, ensue, though a considerable quantity of the pale urine in question has been voided. Dr. Roberts mentions a case almost certainly of calculous blocking, fatal on the fifteenth day by uræmia, in which a daily average of two pints of urine—pale and of a specific gravity of 1006—was discharged throughout. The explanation of the fact lies in the small proportion of excrementitious matter which the urine in these circumstances contains.

may prove fatal though much urine is passed.

Characters of resultant uræmia.

Unless the obstruction be overcome the constitutional signs of uræmia will inevitably appear sooner or later, though they are seldom prominent until within a short time, a few days at most, of death. Once evident their course is rapid. The functions of the stomach are among the first to suffer, as shown by loss of appetite, nausea, and occasional rather than continued vomiting. Sometimes there is much flatulence. Failure of muscular power early occurs and increases with the uræmia. Lassitude and debility are succeeded by embarrassment of breathing, which becomes hurried or slow, panting, and laborious, probably chiefly in consequence of weakness of the muscles of respiration. Finally the heart shares the change, the pulse becomes weak, then slow, irregular, or intermittent, and at last in a large proportion of cases death occurs from asthenia, the ventricles after death being found to be totally uncontracted. The asthenic state of the heart may determine the manner of dissolution, which often takes place suddenly, perhaps upon a change of posture, or while the patient is sitting up, without any premonitory disturbance of breathing or of the mental faculties, death being immediately due to an abrupt failure of the powers of circulation.

Attacks heart more than brain.

Before muscular failure has reached its climax there are other results of blood-poisoning, the most constant of which are muscular twitchings, which occur sometimes almost all over the body. These appear to be generally, though not always, present in advanced uræmia from this cause. General convulsion occurs with comparative infrequency. The tongue, first moist and tremulous, becomes coated, then brown and dry. The functions of the bowels are but little affected. Constipation is sometimes present early in the attack. There is seldom diarrhœa unless due to medicine. Latterly the motions are often dark and peculiarly offensive. The skin is clammy and moist, sometimes there is much sweating, seldom of the distinctly urinous character occasionally observed in other diseases of the urinary organs, more especially with retention. The skin is noticeably cool, and to the thermometer slightly sub-normal (96° or 97°). There is a remarkable absence of dropsy. Notwithstanding that five or six days may have passed but not a drop of urine, or two or three weeks with only as many urinations, the only œdema observed, and even that is exceptional, may be a slight puffiness about the face. The patient is sometimes drowsy, in other cases want of sleep is experienced, he is often restless and sleeps fitfully, with sudden startings, and semi-convulsive disturbance. Low delirium sometimes occurs, but, as a rule, is not a prominent symptom. The pupils are contracted towards the end, sometimes to mere points. In some cases coma supervenes at last, but far less often than in uræmia from other causes. In suppression from calculus, the tendency to asthenia is always marked, and generally gives its character to the closing scene.

Absence of dropsy.

The preceding account has been of necessity founded upon cases which have received the elucidation of a postmortem examination, but it is not to be supposed that the disorder is always fatal, though the mechanical disablement of both kidneys must always involve mortal peril.

In the year 1876 I saw with my friend, Mr. W. Fuller, a corpulent member of Parliament, of about sixty-five years of age, who had ceased to make water. He had often had attacks of gravel, and had passed several small stones with symptoms always referred to the right kidney.

Instance of recovery.

On May 31, the urine up to that time having been clear and pale, he was attacked with pain in the left side, the loin, the groin, and a spot in the abdomen two inches to the left of the umbilicus. This was succeeded by the passage during the night of about six ounces of urine, which contained blood and a quantity of uric acid gravel, and then by an abrupt and total cessation of this excretion. At noon on June 2, when I first saw the patient, he was much inclined to apparently natural sleep; he was asleep when I came, woke readily; described his state clearly, and dropped off again as soon as he had ceased to speak. He had now no pain, tenderness, or distress; there was no nausea; the tongue was a little dry, and the breath had an odour approaching the urinous The pulse ranged from 60 to 68; temperature 97°·0. Mr. Fuller had already applied a poultice made with tincture of digitalis; this was continued; and two drachms of the infusion of digitalis, together with tartrate and nitrate of potash, juniper, squills, and nitric ether were ordered to be given every three hours.

Between one and four on the same afternoon, were passed in several urinations a total of about ten ounces of light-coloured turbid urine; albuminous nearly to one-twelfth, and having a specific gravity of 1009. Under the microscope this displayed pus and blood corpuscles, with flakes of squamous epithelium, but no casts. After this the secretion became natural in character and quantity; on the fourth day of the resumed function a stone of rather large size to have made its exit by the natural channels—it was the size of a small bean—was passed with the urine. It consisted externally of uric acid; it was not cut in two.

The right kidney had evidently been disabled by former calculous disease; the suppression depended on the obstruction of the left. The increasing somnolence indicated that the point of danger had been touched, when the stone happily reached the bladder. During the suppression the patient was driven in a carriage from one house to another; it is not improbable that the various movements, down and upstairs, &c., which this involved, may have helped the descent of the stone.

Insanity and Epilepsy in Connection with Renal Calculi.

The numerous and important nervous relations of the kidney have been elsewhere adverted to, and it has been shown that neuralgia, sometimes of extreme severity, is apt to affect certain branches of the lumbar plexus in connection with the irritation of a renal stone. Remote nervous disturbances, of the kind ordinarily called reflex, may also have their origin in the same irritant. Epilepsy is known to occur occasionally in connection with renal calculi, more especially when their movement, as in entering or traversing the ureter, gives rise to severe pain. It would also seem that there is a concurrence, too frequent to be accidental, between renal calculus and certain forms of mental derangement. Among thirty-three cases from the hospital books in which calculi were found in one or both kidneys, were two of epilepsy with loss of intellect—one of chronic lunacy, and one of dementia, considered to be senile, the patient being eighty-eight, succeeded by mania. Besides these there were four cases of cerebral disease, probably unconnected with calculi, comprising softening, coagulation in the arteries, and meningitis. Counting only the demented epileptics and the lunatics, we still have a larger share of mental disease than usually belongs to thirty-three fatal cases in St. George's Hospital. It will be remembered that Robert Hall, whose sufferings in connection with a renal calculus have been elsewhere described, was twice insane; stones of cystine obtained from the kidney of a lunatic have been referred to (page 904), and I may add the instance of a large collection of stones of triple phosphate, for which I have to thank my colleague Mr. Thomas Smith, which were obtained from a similar source.

CHAPTER XIV.

ON THE TREATMENT OF STONE IN THE KIDNEY.

Mitigation.

Before discussing modes of treatment which aim at cure, and are at best so perilous or so protracted that they are never likely to be otherwise than exceptional in their use, something may be said with regard to alleviation. To this end nature does much, and art can do something. The kidneys are comparatively tolerant of stones; renal calculi, when quite immovable, are often as completely latent; and we may truly say, for the consolation of those who have them, that they are more often a source of inconvenience than of danger.

Regulation of movement.

Much may depend upon a prudent regulation of bodily movement. The patient should avoid whatever causes pain or bleeding, not only for the sake of his present comfort, but to keep off pyelitis and encourage the dormancy of the stone. Jolting is obviously to be guarded against, and tremulous or vibratory movements are often not less injurious. To those who cannot avoid rough carriage travelling by road or railway the evil may be mitigated by the use of an air-cushion as a seat. This I first learned from a surgeon who has been already alluded to as an extreme sufferer from renal calculus. He could scarcely endure the jolting and vibration of his carriage, until he found that by this means the movements could be equalised and the tremor deadened. Riding on horseback is seldom safe. Of all exercise, walking is the best, and is often not only bearable, but advantageous from its influence upon the general health. The intelligent springs of the lower extremity are smoother than the finest contrivances of the coach-builder. The gentleman to whom I have referred, though seldom failing to suffer from other kinds of locomotion, could walk twenty miles a day in Switzerland with much benefit and little inconvenience. A false step, however—missing, for example, the edge of the pavement, and descending for an unexpected three inches—would cause a paroxysm of pain, and was instinctively guarded against. Violent muscular efforts of every kind must be avoided, especially such as cause tension of the abdominal muscles. I have often known a severe attack of hæmorrhage to be brought on by the lifting of heavy weights, or the effort of pulling, as at railway signal levers, and have done good by advising those actively employed to change their callings for sedentary ones.

Use of water.

Patients with renal calculus, or indeed with calculous disorders of any kind, may easily be too sparing of water, the general solvent and antagonist of concretion. It is commonly advisable that this should be soft, as rain water, distilled water, or Malvern water, since salts of lime, even if they have not formed the centre, are seldom altogether absent from the outer parts of stones which have acquired any considerable size. Alcoholic drinks are best avoided; the pain of renal calculus is often decidedly aggravated by them.

Consideration of diathesis.

To such general rules it will be necessary to add others which are called for by the diathesis. These, which have been already discussed, will vary with the nature of the concretion, and be indicated, for the most part, by the habitual character of the urine. For uric acid, pure diet, pure air, exercise, and potash or lithia water; for oxalate of lime, nitromuriatic acid and vegetable bitters—remedies which are equally called for, and to which strychnia and other tonics may be superadded should the urine display a marked excess of earthy salts, and which must be further enforced should the secretion be alkaline from fixed alkali, and phosphates be deposited.

Mitigation of pain;

The pain of renal calculus, varying almost infinitely in amount, calls for a large variation of treatment. It may much depend upon movement, the regulation of which has already been discussed. When the attacks are intermitting and of the neuralgic type, they are often much influenced by the general health, and kept off by fresh air, quinine, and strychnia. When severe, anodynes must be used, the best of all being morphia, or morphia and atropine together, injected under the skin. Prout found the burning sensation sometimes produced by calculi of oxalate of lime and the phosphates to be relieved by the application of pounded ice to the region of the kidney.

Patients need no medical sanction to have recourse to quack narcotics with seductive names, which are as a rule less effective and more disturbing to the general health than the subcutaneous use of the alkaloids which have been mentioned. Sometimes the pain in its neuralgic form in the loin or along the ureter is so agonising that the patient is driven to the inhalation of chloroform. I have known a gentleman thus suffering to go to bed habitually with a bottle of chloroform under his pillow, and to inhale it frequently to the verge of unconsciousness —a dangerous comfort, one seldom to be preferred to the subcutaneous injection of opiates. Local anodynes, plasters of opium or belladonna upon the loins, are of trifling service, and counter-irritants of none. I have known the periodic pain of renal calculus to be as regularly relieved by a full dose of alkali, notwithstanding that the duration and presumed character of the stone were such as to put any solvent action out of the question.

of hæmorrhage;

For the hæmorrhage which a renal calculus causes, rest is the best remedy. Loss of blood from this cause is never so profuse as, like the hæmorrhage from malignant disease, to be a source of immediate danger. Even when considerable it will generally cease after a few days, or less, of quiet. When patients become blanched by this means, as they sometimes do, it is from the frequent provocation rather than the profusion of the bleeding.

When in such cases styptics are called for, recourse may be had to ergot, iron-alum, tannate of iron, gallic acid, or acetate of lead with opium—the last remedy not the least effective, though the least suited for frequent use. Drugs, however, are seldom needed where rest can be obtained.

of pyelitis.

Pyelitis from stone is very indirectly under our control. In the slighter forms, where there is no purulent accumulation, but only a slight discharge connected with the immediate irritation of a movable calculus, rest will do much. When the outlet has become narrowed, and possibly the stone impacted, so that, as often happens, matter collects, a superfluity only making its way through the difficult exit, the continual irritation of the retained matter is apt to make the condition perpetual. The natural remedy, a free opening, is within the reach of practical surgery, and may be associated with the removal of the stone. Sometimes the disease will wear itself out, leaving the kidney as a shell closely fitted upon the stone, and sometimes it will wear out the patient by means of hectic or lardaceous change, danger of either calling for tonic treatment.

It has occurred to me that the curative efforts of nature might be hastened in suitable cases of this kind by external pressure, whereby accumulation in the cyst would be prevented, and its closure and obsolescence invited.

Counter-irritants have had their day. Sir B. Brodie[1] used setons and issues upon the loins in cases where renal suppuration had ensued upon a calculus, and did not doubt that such measures were sometimes eminently useful; the advantage, however, of thus adding one injury to another may well be questioned.

Treatment of renal colic;

The definite symptoms which accompany the descent of a renal calculus—a fit of the gravel, as it is often termed—may require measures to be energetically directed towards the removal of irritation, the relaxation of spasm, and the relief of pain. A dose of calomel, or of some other rapid aperient, may be followed by copious injections of warm water into the bowel, which, if the left kidney be affected, will exert their emollient action in its immediate vicinity. Awaiting the action of the aperient, the patient may be placed in a warm bath, or hip bath, or less effectively treated by hot poultices or fomentations. Opiates, of which none are so suitable as morphia subcutaneously, may be used at once if the pain be severe. Sometimes the anguish is such that the inhalation of chloroform is called for. The free drinking of diluents, where permitted by the state of the stomach, will increase the urine, render it less irritating, and facilitate the passage of the stone. Alkalies may be liberally superadded if the secretion be, as it often is, highly acid.

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[1] *On the Diseases of the Urinary Organs*, edit. 4, p. 256.

of suppression.

Suppression occurs, as has been already explained, when either both kidneys, in pelvis or ureter, are simultaneously obstructed, or, one kidney having been disabled previously, a stone closes the outlet of the other. The treatment of this perilous state is rendered uncertain by the difficulty of ascertaining the precise state of the obstruction. Where this condition has proved fatal, the nature of the obstacle is sometimes discovered to be such as to have conceivably admitted of mechanical relief. Not seldom, as represented at page 954, the obstruction is a conical stone, worn to fit the outlet of the pelvis, lying, like a bullet in a valve, without impaction, maintaining its place and the obstruction chiefly by its weight. In such a case, if the body were inverted, as put in practice long ago by the late Sir James Simpson,[1] the fatal adaptation might possibly be deranged; but the relief at best would be but temporary, since there would be nothing to prevent the stone falling back into the same position.

Other cases occur, like that related at page 965, in which retention has proved fatal when the stone has traversed the whole of the ureter and lodged at its vesical exit, where the canal is at its narrowest. It sometimes inspires a feeling akin to remorse to find how little would have sufficed to have cleared the channel and cured the patient. The merest touch has been enough after death to throw into the bladder a stone, the last stage of whose journey has been thus fatally delayed. The vesical ends of the ureter are not within the reach of external manipulation; but should the stone, as sometimes happens, be exposed to the vesical cavity, the cautious use of a sound might occasion its displacement.

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[1] *Edin. Medical Journal*, 1858, p. 76.

External manipulation of the renal region, and of as much of the course of the ureter as is open to external pressure, has been recommended; and Dr. Roberts found in two cases a transient flow of urine to follow such measures. Walking, if necessary with support, change of posture of various kinds, and blows upon the sacrum have been suggested.

Diuretics are sometimes of use. Of these, digitalis, liberally though watchfully given, promises best. Mr. Brown,[1] of Haverfordwest, published some remarkable cases of this nature which were relieved by the external application of this drug. He applied a poultice to the abdomen, made when the fresh leaves could be got, by bruising them with boiling water; or failing these, by mixing an ounce of the tincture with a linseed poultice. The application was continued until the pulse was decidedly reduced in rate, a matter generally of some hours. A discharge of urine generally, in his cases, accompanied the fall in the pulse, and he describes the abundance of the flow in graphic terms. In an instance where, as he thinks, the remedy was too long persisted in, the suppression was superseded by an alarming diuresis at the rate of eight chamber-vessels full in six hours, under which the patient sank. I cannot adduce my own experience in warrant of such an extreme result, but I have known small stones to be discharged and suppression terminated under the influence of this remedy applied externally and internally, and cannot doubt that it is more effective than any other we know of (see case p. 971).

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[1] 'On the External Use of Digitalis in Suppression of Urine.' *Medical Times and Gazette*, 1868, p. 86.

Terebinthinate and other stimulating diuretics have been used sometimes with apparent advantage, but there is no such evidence in their favour as warrants digitalis.

When all other expedients have been exhausted, and so much time has passed without escape of urine as to leave little hope of natural relief, surgery offers a chance of rescue. Behind the obstruction the pelvis is necessarily distended, and would offer a fair mark to the point of an aspirator. This instrument can in ordinary circumstances be directed upon the kidney without risk; and it is possible that, with care, a pelvis distended with urine might be safely tapped with it, a present exit provided, and an opening left which might be available for future proceedings. The chief difficulty, as I have ascertained on the dead body, is to gauge the depth. Should the distended pelvis be transfixed, it is not impossible that urine might be extravasated into the peritoneum. The safest and surest plan would probably be to dissect from the loin, and open the pelvis as in renal lithotomy, with the incidental possibility of removing the stone, as well as relieving the suppression. I may refer to a case related at page 956, in which this operation was designed, though its performance was anticipated by the death of the patient. It must be a matter of nice judgment to time the operation—not until all chance of relief by discharge of the stone is over, and before there be any such constitutional results of suppression as to make it unlikely that the patient should survive any operative procedure.

Renal Lithotomy, and Excision of the Kidney for Stone.

Renal calculi have been assailed by two methods, excision of the stone with or without the kidney, and solution; solution may be put aside for the present, as of little practical issue, and the first consideration given to renal lithotomy.

It has been shown by what various channels renal stones, if they be small, may escape from the body, and it has often happened that when their course has been towards the surface, their efforts at escape have been crowned by their artificial removal from sinuses and superficial abscesses. The cautious surgery of nature is surrounded by safeguards which rarely attend the rougher operations of art.

When nature has thus shown the way, calculi of considerable size have been extracted.

Extraction of stones from sinuses.

Mr. Annandale[1] successfully drew a branched stone weighing 72 grains, which no doubt lay in the pelvis of the kidney, from the bottom of a lumbar sinus three inches in depth; and many other instances are known in which small stones have been taken from near the surface, or have effected their escape without extraneous aid.

Surgery, long limited to thus assisting nature, has of late years taken the initiative, with the result of showing that renal lithotomy is possible without any help or guidance on her part. The feasibility of this operation is so important a question that I shall briefly review the existing experience of it, as far as it has come to my knowledge: it is probable that as a record of fruitless attempts and fatal performances the list may be incomplete, but it is to be presumed that no successful extraction of a stone from the kidney has escaped notice.

Renal lithotomy, its history.

The cutting out of renal calculus appears to have occupied the thoughts of surgeons from remote times, and even to have been once successfully accomplished at a comparatively early date with or without the aid of a natural fistula.

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[1] *Edinburgh Medical Journal*, July 1869.

I exclude, as beside the question, the archer referred to in Mezeray's 'History of France' as of Baguelet, and of the time of Louis XII., who is there stated to have undergone the removal of a stone from 'the kidneys' instead of the execution of a sentence of death which he had incurred.[1] Mezeray gives no authority, but the story is to be traced to Ambrose Paré, who, writing in the year 1579, relates it as follows:—[2]

This narrative exceeds not only all admiration, but also belief.

The following history, taken out of the Chronicles of Monstrelet, exceeds all admiration. 'A certain Franck-Archer of Meudon, four miles from Paris, was for robbery condemned to be hanged; in the meanwhile it was told the King by the physicians, that many in Paris at that time were troubled with the stone, and amongst the rest the Lord of Boscage, and that it would be for the good of many if they might view and discern with their eyes the parts themselves wherein so cruel a disease did breed, and that it might be done much better in a living than in a dead body, and that they might make trial upon the body of the Franck-Archer, who had formerly been troubled with these pains. The King granted their request; whereupon, opening his body, they viewed the breathing parts, and satisfied themselves as much as they desired, and having diligently and exactly restored each part to its proper place, the body, by the King's command, was sewed up again, and dressed and cured with great care. It came so to pass that this Franck-Archer recovered in a few days, and getting his pardon, got good store of money besides.'

The operation was not so much lithotomy, either renal or vesical, as vivisection, intended not so much for benefit of the Archer as of the Lord of Boscage. The Archer recovered from the experiment, each part having been 'diligently and exactly restored to its proper place.' Whether he recovered from the stone, where it was, or whether, indeed, he had any disease at the time of the operation, though he 'had formerly been troubled with these pains,' upon these points the narrator is silent.

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[1] Mezeray's *History of France*, published 1685. Vol. ii. p. 879.

[2] *Works of Ambrose Paré.* Translated by Thomas Johnson, p. 668.

The expressive marginal note belongs to Ambrose Paré. I have searched the Chronicles of Monstrelet for the original story but without success.

Mr. Hobson's case.

The first instance of the operation on which reliance can be placed is the oft-quoted one of Mr. Hobson, the Consul at Venice, from whose kidney several stones were excised by Marchetti of Padua. The incision was made through the back 'into the body of the kidney,' from whence two or three small stones were removed at the time, and another the size of a date-stone escaped afterwards by the fistula which remained. The fistula was open ten years afterwards, and still discharged urinous fluid; but for this the cure was complete. The case is reported by Mr. Charles Bernard, in the 'Philosophical Transactions' for 1696; it was drawn up from the narrative, not of the surgeon but of the patient, corroborated by an examination of the sinus ten years after the operation. The story has detail and the appearance of truthfulness, and must claim belief at least in the point of chief interest to the patient, the cutting into him deeply from behind and extraction of stones by the wound. What guide the surgeon had may have been less vividly recalled: there may have been a previous sinus, though none is mentioned. Indeed it is highly probable that this was the case. The patient himself suggested the operation, imploring Marchetti 'that he would be pleased to cut the stone out of his kidney,' to which the surgeon responded by a course of dissection which extended over two days. It is not to be supposed that both patient and surgeon could have been thus assured of the existence and position of the stone, had not there been some external evidence of it; while the tedious nature of the operation is consistent with the careful following of some such guide. As a rule, a renal stone does not impress itself distinctly as such upon its bearer; he knows that he has certain discomforts, but the cause of them is a matter of inference, which even in these days is often erroneous, as the results of nephrotomy testify. Two hundred years ago the means of diagnosis were less, and the doubts which must have beset such a case, proportionately greater.

The next case is even less explicit; it is stated in the 'Gentleman's Magazine' for August, 1773, that 'Mr. Paul, a surgeon at Stroud, in Gloucestershire, lately extracted from the kidneys of a woman by an incision through her back, a rough stone as large as a pigeon's egg, and made an entire cure.'[1] No further particulars are known.

For the origin of nephrolithotomy we must revert to Marchetti, the citation of whose case by Mr. Thomas Smith and the observations with which it was accompanied appear to have been the chief agents in the recent introduction of the operation, whether it be regarded as a revival or a novelty.

TABLE I.

Cases of Renal Lithotomy performed or attempted, in which a Stone was found.

Operator and Reference	Case	Result
1. W. W. Dawson, M.D., Ohio. Operation, October 24, 1872. ('New York Medical Journal,' 1873, p. 35).	Female, aged 50. Recurring attacks of hæmaturia for eight years; latterly discharge of pus with urine. Tumour in left renal position, which extended from the loin to within 3 inches of the umbilicus, and measured 4 inches vertically. Much pain in left lumbar and iliac regions. Flexure of left thigh. Increase of pain and swelling with diminution of discharge of pus.	Died of pyæmia on fifth day after operation

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[1] Quoted by Mr. Morris, *Medical Times and Gazette*, April 10, 1880, p. 409.

Operator and Reference	Case	Result
	Exploring trocar introduced into tumour with withdrawal of pus. Incision made from last rib to crest of ilium, after the manner proposed by T. Smith. Kidney explored and incised to depth of ½ inch. Calculus removed from pelvis, and drainage tube inserted. Stone weighed only 20 grains; ⅞ of an inch long, ½ inch broad, composed of ammonio-magnesian phosphate	
2. Mr. Callender. Operation, June 23, 1873. ('St. Bartholomew's Hosp. Reports,' vol. ix. p. 221)	F., aged 44. Large oval tumour in abdomen, extending into right iliac fossa and nearly to umbilicus. Colon traced over its anterior aspect. Much pain in right side, extending down thigh. Blood and latterly pus in urine. Emaciation and hectic. Incision as for colotomy; cavity of kidney laid open and much concrete pus removed. Branched calculus removed after portions had been broken from it with bone forceps. Stone weighed 1½ ounce, composed of lithates coated with phosphates	Sank after operation, and died on third day
3. Mr. Morant Baker. Operation, October 28, 1874. ('Transactions Medical Congress,' vol. ii. p. 265)'	F., aged 43. Urine turbid and purulent. Tumour in right renal region, which was punctured, and 8 ounces of pus withdrawn. Three weeks after, incision made in right loin as for colotomy; cyst exposed, opened and a large branched calculus felt, the greater part of which was removed in pieces with difficulty—a deeply-placed fragment was left behind. Patient never fairly rallied from the operation, and died three days afterwards. No *post-mortem*. Stone which was removed weighed nearly 2 ounces, and consisted almost entirely of phosphate of lime	Died three days after operation
4. Mr Savory. Operation, January 29, 1876. (St. Bartholomew Statistical Report, 1876. Private information from Mr. Savory)	F., aged 40. Had symptoms of stone in kidney and abscess, pointing in left loin. This incised with relief, small fistula remaining. About ten months afterwards oblique incision made in loin, guided by the fistula, and stone extracted from pelvis of left kidney. Stone measured 1¼ inch by ½ inch. Consisted of uric acid	Made a good recovery

Operator and Reference	Case	Result
5. Mr. Teale. (Referred to in Mr. Wheelhouse's Address in Surgery, 'Brit. Med. Assoc.' 1878, p. 45	Attempt to remove stone from the kidney by incision through the loin, but none found at the time of operation. After death stone found impacted in the upper part of the ureter	Died a few weeks afterwards
6. Mr. Morris. Operation, February 11, 1880. (Report of Clinical Society,' Lancet, October 30, 1880)	F., aged 19. For eight years pain in right side with feeling of sickness or vomiting. Repeated attacks of hæmaturia. No pus in urine. Lumbar tenderness, but no swelling Right kidney exposed through oblique lumbar incision, renal substance incised, and mulberry calculus extracted, weighing 31 grains	Made a good recovery, sinus left in loin, which did not communicate with kidney, but discharged a trifling amount of pus at intervals. Patient able to work hard as a servant
7. Dr. Whipham and Mr. Warrington Haward. Operation, May 19, 1881. ('Clinical Transactions,' vol. xv. p. 117)	A married woman, aged 23. Seven years previously had passed, by the urethra, a rough calculus as large as a date-stone. Later much pain in left loin increased in paroxysms. Pus, and sometimes blood, in urine. Tumour felt in left renal region, which, under chloroform, was ascertained to extend about four inches downwards from the lower ribs and about as far from the outer border of the loin towards the median line. Incision made as for lumbar colotomy, dilated kidney exposed and opened, with evacuation of 2 ounces of purulent fluid, and removal of calculus from lower part of cavity. Drainage-tube left in wound. Gradual recovery; a small sinus which remained ultimately healed, and in January 1882 patient was seen in perfect health	Cured
8. Mr. Marcus Beck. Operation, August 16, 1881. ('Clinical Soc. Trans.' vol. xv. p. 103)	Male, aged 19. Subject to pains in back since age of 7. Two years before operation occasional hæmaturia; increased pain, affecting left loin, testicle, and buttock, made worse by movement, and occurring in paroxysms. Frequency of micturition. Slight fulness felt in left loin. Urine free from albumen; alkaline; contained only trace of pus. Kidney exposed by lumbar incision,	Cured

Operator and Reference	Case	Result
	explored with a needle, and stone felt. Kidney opened and stone removed, which was found to weigh 26 grains, and to be composed of uric acid and phosphates. Wound was healed by 35th day, and patient convalescent. Irritability of bladder ceased after removal of stone. Small quantity of pus still found in urine. Resumed work	
9. Mr. Butlin. Operation, October 25, 1881. ('Clinical Soc. Trans.' vol. xv p. 113)	Male, aged 20. Severe 'neuralgic' pain and retraction of right testis: some pain in lumbar region; urine contained oxalate of lime crystals, and trace of albumen. Kidney exposed by vertical incision along the border of the erector spinæ, and a soft spot felt, in which was a hard body. This, which proved to be a stone, was exposed and removed. It was of oxalate of lime, and weighed 60 grains. The neuralgia of the testis ceased, but pus appeared in the urine after the operation, though there had been none before. This eventually ceased, and the patient perfectly recovered	Cured
10. Dr. Whipham and Mr. Warrington Haward. Operation, Nov. 3, 1881. ('Clinical Soc. Trans.' vol. xv. p. 123)	Laundress, aged 56. Pain with micturition; frequent passing of gravel, and occasional hæmaturia. Pain in left flank and groin, increased by movement. Urine alkaline; passed in small quantities; specific gravity 1,006; contained pus, with crystals of uric acid and of the phosphates. Muscular resistance and fulness in left loin, but no distinct tumour felt; in right loin much fulness, pain on pressure, but no distinct fluctuation. In front of abdomen universal tenderness. October 6 incision made in centre of left lumbar swelling, cavity of kidney opened, but no stone felt. Much pain about wound, and discharge from it. On November 23 wound enlarged and further explored; no stone found. Patient never rallied, but sank on the following day. *Post-mortem*—Left kidney dilated; pelvis opened into suppurating cavity behind it, into which incision had been	Sank

Operator and Reference	Case	Result
	made. Two or three small pieces of calculus, like pins' heads, had formed in calyces. Large branching calculus in right kidney, which almost blocked ureter	
11. Dr. Bardenheuer, Cologne. ('Medical Record,' Feb. 15, 1883, p. 40	Man, aged 27. Portion of elastic catheter broken into bladder—consequent cystitis with abscess in left iliac fossa, which presumably became connected with the pelvis of the *left* kidney. Five weeks later rigor and suppression of urine occurred. A catheter brought from the bladder only mucus and a small calculus. Obstruction of the *right* kidney by calculus diagnosed. Incision made from the eleventh rib to the crest of the ilium. Stone felt in the hilum. Pelvis exposed at bottom of wound, and stone as large as a bean, with several smaller pieces, ultimately removed through an incision in the commencement of the ureter. Urine afterwards passed entirely through wound. Four days later ureter cut and upper end fixed in wound, through which urine was permanently discharged. At date of report wound uniting, and patient recovering, though feeble	Permanent discharge of urine through the wound in loin. Recovery incomplete at date of report
12. Mr. Bennett May, Birmingham. Operation, October 20, 1882. Clinical Society, February 9, 1883	Coal miner, aged 34. Symptoms since sixteen, hæmaturia, ropy discharge, pain in loin increased by exertion. Occasional attacks of renal colic, small stone passed. Incision from the loin, stone not felt with finger, but by acupuncture. Kidney, apparently healthy, incised vertically and stone extracted which was 3 inches long, and weighed 1 ounce. Chiefly phosphatic. Much bleeding, pain and shock. Subsequent slight pleurisy	Wound perfectly healed and recovery complete
13. Mr. Berkeley Hill. Operation, March 21, 1883. Private information	Female, aged 26. For several years attacks of pain in right hypochondrium and vomiting. Fluctuating swelling in loin, from which 4½ ounces of pus removed by aspiration. Cavity of kidney evacuated by lumbar incision and stone taken out, apparently consisting of oxalate of lime. It weighed 64 grains and measured $1\frac{1}{3}$ inches in length. Urine	Patient in perfect health 9 weeks after operation, except that urine still contained pus

Operator and Reference	Case	Result
	ceased to escape by wound 16 days after operation. Wound closed in 31 days. Coexistent urethritis and vaginitis	

Renal Lithotrity.

Operator and Reference	Case	Result
14. Peters. 1880. 'Berliner Medic. Wochenschrift.' (Referred to by Mr. Barker, Clinical Soc. 'Lancet,' October 30, 1880)	Symptoms of renal calculus were verified by the passage of trocar and canula, and the striking of a stone in the kidney. Canula left in for some time, after which wound dilated by tents, until the sinus was large enough to admit the finger. Lithotrite passed, stone crushed and removed. Sinus afterwards healed[1]	Cured

TABLE II.

Cases of attempted Renal Lithotomy in which no Stone was found.

Operator and Reference	Case	Result
1. Mr. Durham. Guy's Hospital, February 3, 1870. ('Med. Times,' Feb. 12, 1870)	F., aged 41. Incision along the edge of the erector spinæ, from the pelvis to the eleventh rib, hilum of the kidney reached with little difficulty, but no stone found. Pelvis and ureter examined on the outside, but not opened. All appeared perfectly healthy. Recovered from operation, but not relieved of pain, hæmaturia, and other symptoms from which she had suffered. [For conclusion of case see Table IV., Case 1]	Recovered from the first operation
2. Professor Moses Gunn. Chicago, April 16, 1870. ('New York Medical Journ.' 1873, vol. xvii. p. 47)	Man, 'who for five months had suffered from symptoms which indicated the probable presence of a renal calculus.' Kidney exposed from behind; pelvis and commencement of ureter examined, but no stone found. Organ seemed shrunken and soft, but was not interfered with. Recovered from	Recovered

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[1] See also Cases 5 and 6 in Table III.

Operator and Reference	Case	Result
	the operation; nausea, which had been nearly continuous, was relieved, and pain disappeared. These symptoms returned six weeks afterwards	
3. Mr. Bryant. 1870. ('Lancet,' July, 1870, p. 13; also August 27, 1870, p. 292)	Fulness perceptible to hand and eye in left loin; pain down spermatic cord. Pus in urine. Diagnosis of renal cyst containing pus. Stone to be removed if found. Oblique incision in loin like that for colotomy. Kidney fairly exposed; curved trocar passed through its cortex, and flow of pus ensued. Pelvis explored internally, but no stone found. After death kidney found to be the seat of tuberculous excavation; no stone present Incision, which had entered back of pelvis, was healing	Died on twenty-fifth day after operation, of acute peritonitis, which supervened upon chronic
4. Mr. Bryant. 1878. (Private letter)[1]	Lady, aged 56. Passed a stone six years before, after an attack of renal colic on the right side. Pain relieved but not removed; continued of a dull aching character. Pus in urine. Right lumbar region incised down to kidney, and 10 ounces of pus evacuated. Kidney found 'honey-combed,' but no stone discovered. Operation gave relief at once; pus disappeared from urine. For a time urine passed through wound, which was washed out daily with iodine water. In two months lumbar opening closed, and patient well	Recovered
5. Mr. Golding Bird. (Discussion at Clinical	Intense 'renal neuralgia' on the left side, in a boy, from whose urethra an impacted calculus	Recovered

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[1] I have to thank Mr. Bryant for giving me the advantage of his large experience, both published and unpublished. In his well-known work on surgery (edit. 3, vol. ii. p. 57) are two cases in which he cut from the loin into a renal swelling, evacuating in one instance 3 pints, in the other a quart, of pus. In the latter the finger was easily passed into the dilated pelvis of the kidney. As to the results of these operations, one patient 'made a good recovery,' the other received 'marked benefit.' I have been informed by Mr. Haffenden, under whose care one of these patients now is (April, 1881), that she has a permanent fistula as the result of the operation, through which what appears to be all the urine of one kidney makes its exit. I have not included these cases in the table, as the object in view appears rather to have been the release of imprisoned matter than the removal of stone.

Operator and Reference	Case	Result
Society. 'Lancet,' October 30, 1880)	had been removed; also pain in bladder. Kidney cut down and explored, back and front, but no stone found. Temporary relief, then pain returned. Afterwards Mr. Durham cut into bladder, but no stone found	
6. Dr. Baxter and Mr. Morant Baker. ('Trans. Med. Congress,' vol. ii. p. 262. Dec. 7, 1880)	Girl, 7 years of age. Attack of hæmaturia eighteen months before admission; another subsequently. Urine became purulent. Swelling in region of right kidney; much hectic. Incision made as for lumbar colotomy; no stone found. Drainage-tube inserted; pus in urine and hectic continued. (*See* Table IV. Case 5.)	Survived operation, but received no benefit
7. Mr. Morant Baker. ('Trans. Med. Congress,' vol. ii. p. 264. May 15, 1881)	Boy, aged 16 years. Frequent attacks of pain in left renal region for four years before admission. Fluctuating tense swelling, evident during attack of pain, in left renal region; subsiding afterwards, with discharge of pus with the urine. Incision as for lumbar colotomy; dilated kidney exposed and incised, but no stone found. Patient recovered from operation with permanent fistula, in which a drainage-tube was inserted	Recovered from the operation
8. Mr. Clement Lucas. (Private letter, 1881)	Man, aged 48, who for two years had had hæmaturia, and passed pelvic clots. Kidney exposed by an incision parallel to last rib, and felt all over without discovery of stone. The kidney does not appear to have been opened. The wound readily healed, and the patient left his bed in a fortnight	Recovered from the operation

TABLE III.

Removal of Kidney for Stone, either as Sequel to Lithotomy or independently. Stone present.

Operator and Reference	Case	Result
1. Simon (Heidelberg) Aug. 8, 1871. Barker ('Medico-Chir. Trans.' vol. lxiii. p. 210)	F., aged 30. Symptoms of calculous pyelitis for twelve years. Kidney extracted by lumbar incision. Vomiting and abdominal pain afterwards. Kidney small, fibrous; contained calculus	Died on thirty-first day of pyæmia
2. Muller (Oldenburg) February 18, 1878. Barker ('Medico-Chir. Trans.' vol. lxiv. p. 272	M., aged 21. Symptoms of calculous pyelitis for three or four years. Renal abscess opened in September, 1877, and drained. Nephrectomy by lumbar incision, when fistula closed. Perinephritic abscess afterwards, which had to be drained into rectum. Kidney dilated into sac with adherent calculi	Recovery complete after 16 months
3. Czerny (Heidelberg). March 15, 1880. Barker, ('Medico-Chir. Trans.' vol. lxiv. p. 278)	M., aged 23. Pain and hæmaturia from childhood. Pain increased by exercise, which latterly became impossible. Nephrectomy by lumbar incision; which had healed in fourteen days. Small calculus in slightly dilated, but otherwise healthy, kidney	Recovered
4. Barker (London), July 5, 1880. ('Medico-Chir. Trans.' vol. lxiv. p. 278)	F., 32 years. Renal pain since childhood; swelling noticed one month. Pyonephrosis diagnosed, and attributed to calculus. Nephrectomy by lumbar incision. Kidney vascular and dilated. Small calculus in mouth of ureter	Death from shock in four hours
5. Barker (London). October 5, 1880. ('Med.-Chir. Trans.,' vol. lxiv. p. 278. 'Lancet,' Oct. 30, 1880)	F., aged 38 years. Anæmic. Pain fifteen months. Pyelitis. Swelling twelve months. Diagnosis between stone and tubercle, determined by striking stone with needle passed through loin. Kidney exposed by lumbar incision, and opened. Large branched stone found, but only a portion extracted. Kidney then enucleated and tied, after which it was found that stone could be extracted. Kidney sacculated. Colon torn in course of operation	Died of shock in twelve hours
6. Barwell (London). May 5,	M., aged 18 years. Swelling in loin, which broke and dis-	Recovered. Sinus left,

Operator and Reference	Case	Result
1881. ('Trans. Med. Congress,' vol. ii. p. 275)	charged. Urine contained mucopurulent matter, and afterwards much pus. On October 18, 1880, incision as for lumbar colotomy; 6 ounces of pus discharged; sinus left, at bottom of which stone was ultimately felt. May 5, 1881: Another lumbar incision outside sinus; stone found to be deeply imbedded; broke and could not be removed. Kidney therefore ligatured and removed. Many fragments of stone came away during operation and afterwards	through which little urine came
7. Dr. Barlow and Mr. Godlee ('Clin. Trans.,' vol. xv. p. 134. July 15, 1881)	Married woman, aged 57. Passed stone twenty-six years before. For three months pains in back. Urine thick, milky, and frequent. Tumour felt in right side from ribs to within finger's breadth of crest of ilium, at lower part of which was projection, which was thought to be calculus. Much pus in urine. Legs œdematous at times. Stone felt with needle introduced through loin. Kidney removed by incision in medium line of abdomen. Operation protracted. The kidney, which had been removed, contained several calculi of uric acid; it was almost entirely disorganised. Other kidney healthy	Sank twenty-four hours afterwards
8. Rosenbach, July, 24, 1881. 'Berliner Klinische Wochenschrift,' January 30, 1882	Male, aged 43. Frequent attacks of hæmaturia since age of 18. Passed many stones of size of lentils. Swelling in loin which was punctured, and pulpy and chalky matter let out. Hæmaturia recurred after puncture. Some months afterwards kidney removed by lumbar opening. Found to contain matter and many concretions of phosphate of ammonia and magnesia, the largest of which were of the size of cherries	Perfectly recovered by November 12, 1881
9. Dr. Williston Wright, (New York), October 14, 1882. 'New York Medical Journal,' February 17, 1883	Married woman, aged 34. For 9 years, pain in right loin. For 4 years urine ammoniacal and contained pus and blood. Procidentia of uterus and bladder of long standing, consequent upon labour. Tumour as large as fist felt in right loin, at inner margin of which was nodulated lump as	Recovered from the operation. Remained in weak health with much discharge of pus with urine.

Operator and Reference	Case	Result
	large as walnut, thought to be stone. Kidney removed by incision along edge of rectus muscle. Left kidney felt through wound in normal position. Right kidney pyelitic, contained phosphatic stone weighing 135 grains. Obstruction of bowels after operation. Wound reopened and abscess found near stump of divided vessels which pressed on ascending colon. Three ounces of pus discharged and obstruction relieved. Abscess thought afterwards to discharge into bladder.	

Table IV.

Removal of Kidney for Stone, either as sequel to attempted Lithotomy, or independently. No Stone Present.

Operator and Reference	Case	Result
1. Durham (London). May, 1872. ('New York Med. Journ.' vol. xiv. p. 485. 1872. 'Brit. Med. Journ.' May, 1872.) See Case 1, Table II.	F., aged 43. Reported as case of attempted lithotomy in Table II. Two years after this operation, patient not having been relieved of pain, hæmaturia, and other symptoms, right kidney removed by lumbar incision, and found to be healthy. Details wanting	Died a week afterwards
2. Peters (New York), May 16, 1872. ('New York Med. Journ.' vol. xvi. p. 473. 1872)	M., aged 36. Symptoms for nineteen months. Frequency of micturition; pains in bladder and right renal region; much pus; and occasional streak of blood in urine. Swelling of right testicle and spermatic cord. Enlargement in position of right kidney; aspirator withdrew 3 ounces of pus; supposed fragments of stone in eye of trocar. Incision from lower border of twelfth rib to crest of ilium. Kidney found to contain pus; no stone discovered. Thought to be useless and to have been damaged in operation—therefore removed. Found to be extensively tuberculous, as also	Sank sixty-five hours afterwards

Operator and Reference	Case	Result
	were right ureter, seminal vesicle, and epididymis	
3. Dummreicher (Vienna). Aug. 6, 1877. (Barker, 'Med.-Chir. Trans.' vol. lxvi. p. 272)	M., aged 33. Weak and anæmic. Symptoms from childhood, worse for ten years. Pyelitis supposed to be of calculous origin; with perinephritic abscess on left side. Nephrectomy by lumbar incision. Pleura wounded in course of operation. Kidney vascular and dilated; imbedded in dense inflammatory tissue. No stone	Died on second day
4. Stockwell (Bath). June 2, 1880. (Barker, 'Med.-Chir. Trans.' vol. lxiv. p. 280)	M., aged 54. Passed calculi twenty-six years before. Healthy until fourteen years before. Symptoms of calculous pyelitis. Lumbar incision. Kidney difficult to remove in consequence of dense mass of adherent tissue by which it was surrounded. Severe hæmorrhage from renal veins. Kidney enlarged and sacculated	Died in ten hours from hæmorrhage
5. Morant Baker (London). Feb. 22,1881. ('Trans. Med. Congress,' vol. ii. p. 262. See Case 7,Table II.)	F., aged 7 years. Attack of hæmaturia eighteen months before admission; another subsequently. Urine became purulent. Swelling in region of right kidney. Much hectic. December 7, 1880, incision as for lumbar colotomy. No stone found. On February 22 kidney removed through place of former incision. Kidney scrofulous. Much improvement; but in July, 1881, urine still contained pus	Much improvement
6. Howard Marsh (London). Dec. 1881. ('Clin Trans.,' vol. xv. p. 140)	M., aged 58. Pain in right loin three years before admission. Urine then purulent, fœtid, and passed with frequency. Urine sometimes nearly clear; discharge reappearing with rigors and paroxysm of pain from loin to testis. Pyelitis diagnosed; probably of calculous origin. Kidney exposed by lumbar incision, and much pus let out. No stone found. Removal of kidney attempted, but only partially accomplished. Right kidney found to be sacculated in consequence of stricture of ureter of uncertain origin, and surrounded by adhesions. Opposite kidney natural	Died with suppression of urine thirty hours afterwards
7. J. Adams (London). March. 1882. (Private	M., aged 30. Hæmaturia for two years; latterly constant and profuse. Clots expelled with diffi-	Recovered from immediate effects, but

Operator and Reference	Case	Result
letter)	culty. Constant pain in right loin; no increase of lumbar dulness. Phosphates, blood, and epithelium; but no casts in urine. Marked anæmia. Incision in loin; no stone found. Kidney then excised—it proved to be the seat of a malignant growth	died in two months from secondary growths

ABSTRACT OF TABLES.

Number of persons operated upon for stone in kidney . .	35
Stone present in	22
Stone not present in	13

State of Kidney in 13 *Cases in which Stone was not found.*

Tuberculous, or scrofulous	3
Seat of malignant growth	1
Dilated or sacculated from pyelitis of uncertain cause	5
Healthy	1
Not ascertained	3
	13

TABLES I. AND II.

Renal Lithotomy and Lithotrity.

	Stone Present			No Stone Present		
	Cases	Recovered	Died	Cases	Recovered	Died
Renal Lithotomy performed, or attempted, without nephrectomy . . .	13	8	5	8	7	1
Renal Lithotrity . . .	1	1				

Tables III. and IV.

Nephrectomy for Stone.

	Stone Present			No Stone Present		
	Cases	Recovered	Died	Cases	Recovered	Died
Lumbar nephrectomy, in some cases immediately preceded by attempted lithotomy .	7[1]	4	3	7[2]	2	5
Abdominal nephrectomy .	2	1	1			

Particulars of 22 Operations for Stone existing in the Kidney, referred to in Tables I. and III.

Operation	Number of cases	Recovered	Died
Stone removed by lumbar incision, without previous sinus	9	6	3
Stone removed by lumbar incision, sinus previously existing	1	1	
Lumbar incision, but stone, which was in ureter, not reached	1	—	1
Lumbar incision. No stone found at operation, though minute calculi existed. Large stone on opposite side	1	—	1
Lithotrity through puncture in loin . . .	1	1	
Lumbar nephrectomy, in many cases succeeding upon attempted lithotomy	7	4	3
Nephrectomy through abdomen without incision in loin	2	1	1
	22	13	9

Analysis of tables.

I have annexed in a condensed form the particulars of thirty-five cases in which operations have in recent times been performed for stone in the kidney, omitting several of which the result is uncertain or not fully stated; the catalogue, even if not complete, may fairly represent present experience. First, as to the existence of the disease which it was designed to remove, it appears that in thirteen of these cases no stone was found, a proportion of erroneous diagnosis which is certain to diminish now that attention is called to this subject. It can scarcely be accepted as a persistent rule that in a third of the instances in which a renal stone is confidently diagnosed, no such concretion exists. Did the difficulty of diagnosis amount to this, the feasibility of any operation for its removal with or without the kidney would scarcely need further discussion. But, as in many novel enterprises, the early adventurers fell into errors, which may serve as warnings against their repetition. The incision into and the removal of the healthy kidney presents itself in this light. With such facts before us as the tables present, we may at least insist that no operation for the relief of renal calculus be undertaken on the evidence of pain or general symptoms, unless corroborated by the discharge of blood or pus, or at least, as in Mr. Butlin's case, of crystals and albumen. The doubt likely to occur in future, is not between disease and no disease, but between stone and tubercle. The distinctions have been detailed elsewhere (pp. 807, 926). With tubercle there is usually a characteristic look, family history and temperature, and often disease possibly incipient in the lungs. The pain is not acute, nor does it widely extend, nor is it aggravated by movement or in paroxysms. Hæmaturia is the exception, cystitis the rule. With stone, these statements may be reversed. By way of ensuring the diagnosis, a calculus has been struck with a needle inserted behind; this could scarcely be reckoned upon unless, as in a case in which Mr. Barker thus detected a stone, it presented a large surface. Manual explorations by the rectum may sometimes be of use, and an instance has been referred to in which the grating of stones in the kidney was felt through the abdominal wall. It has been supposed that single stones could be detected by palpation through the integuments, particularly in children and under chloroform, but though a lump may be thus discovered in the renal position, its nature may be doubtful. A stone diagnosed by this means has, within my knowledge, turned out to be tubercle. As a rule, the diagnosis of stones in

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[1] One of these cases is also counted in Table I., as lithotomy had been attempted at an earlier date.

[2] Two of these cases are also counted in Table II., as lithotomy had been attempted at an earlier date.

Diagnosis often erroneous.

Rules for its guidance.

the kidney rests not on any one certain indication, but on the concurrence of a number each of which and all together may be mistaken. A somewhat careful balancing of evidence is often needed, which in the cases before us does not appear always to have found place. A doubt as to the existence of a stone must, as a rule, negative any operation for it, notwithstanding that it is clear that the kidney can be cut into from behind, whether tentatively or otherwise, without great danger, supposing that nothing else is attempted.

Putting aside all operations founded upon erroneous diagnosis, and considering only those undertaken for the removal of existent calculi, we have the following results:—

Results of renal lithotomy.

The kidney has been opened from the loin for the purpose of removing a stone from it, in sixteen cases, in fourteen of which the operation was limited to lithotomy or lithotrity, and is accordingly detailed in Table I.; in two nephrectomy was executed upon the failure of the less formidable procedure, and the instances therefore referred to in Table III. Of the sixteen operations, eight were immediately successful; eight unsuccessful; six fatal. Of the unsuccessful operations, two were, as stated, followed by nephrectomy, once with a favourable, once with a fatal issue. In one of the cases of successful lithotomy there was a previous sinus; in seven, none. One instance is included in which the stone was crushed, and then removed through a puncture rather than an incision. In two of the cases counted as successful, a sinus was left at date of the report, one of which did not communicate with the kidney; in the rest healing was complete. Among the unsuccessful cases was one in which the stone was not on the side of the operation, one in which it was inaccessibly placed in the ureter.

The removal of the kidney, together with the stone, presents itself as a much more dangerous operation than simple extraction of the stone, and probably will not be resorted to but upon failure of the smaller project.

Its dangers.

The causes of death after renal lithotomy are not stated in every fatal case, but it is to be remarked that extravasation of urine finds no place among them. Of four cases where the manner of death is stated it occurred from sinking in three instances; from pyæmia in one. Among the results of nephrectomy for existing stone we find similar dangers; shock or sinking in three cases; pyæmia in one. Peritonitis presented itself as a cause of death in one instance, in which a tuberculous kidney was explored for stone, but did not occur as the result of any operation in which calculus was correctly diagnosed. Suppression of urine occurred in one case of fatal nephrectomy in which no stone was found.

Grave as the recorded results are, they are encouraging and are daily becoming more so; we owe a debt of gratitude to those surgeons whose enterprise has placed renal calculus in the list of curable diseases. Mistakes of diagnosis can scarcely be so frequent in the future as in the past, and the attempt to remove bodily a kidney from which a stone could not be extracted, or in which it could not be found, is an addition to the mortality which may be avoided. It appears that a kidney may be laid open from or exposed behind without special danger, and with a death rate represented, so long as no evisceration be attempted, by six deaths in twenty-two cases. It is to be expected that with further experience the operative process will improve, and to be hoped that in future surgical enterprise may be more successfully guided by medical judgment.

Feasibility of the operation and circumstances which call for it.

The system is tolerant of renal calculi more so than of vesical; with pain slight, and danger remote or hypothetical, no such operation as in question can be justifiable. But in some cases the pain is so great as to warrant much risk in search of cure, and in others the tendency of the disease is such that, should an operation kill, it will only anticipate by a little the action of nature. In such circumstances it may be right to cut for stone in the kidney, accepting the teaching of experience mainly in two respects—not to do so when the diagnosis is doubtful, and, in doing it, to do as little as possible. Another rule which may be laid down, is not to cut for stone if the renal discharge intermits and accumulates, since this habit would indicate obstruction in the ureter, a condition which no operation would be likely to remove. A discouraging consideration is the possibility that, if the stone be of long standing and presumably phosphatic, it may be of such a size or branched in such a manner as to make its removal during life clearly impracticable.

The frequency with which stone affects both kidneys (about one case in five) can scarcely be held to militate against the operation. The danger of it may be somewhat more if there be any obstruction of the unconcerned kidney; but in this case there is the greater need that the risk should be incurred, since it is an attempt to remove a condition which is one of mortal, though, perhaps, not immediate peril.

SOLVENT TREATMENT OF RENAL STONES.

Early attempt

When an imperfect and much dreaded process of lithotomy was the only method of removing stones in substance from the bladder, lithonthryptics, as they were called, were sought eagerly and not altogether without success, though the composition of urinary calculi was then unknown, and the search was guided solely by empirical considerations. Alkalies were early used for this purpose. Basil Valentine used a fixed alkaline salt in calculous disorders, and Sennertus in similar circumstances is said to have employed cream of tartar. The search received a later direction from Joanna Stephens. Her nostrums for the solution of stone having become notorious, Parliament, acting by the advice of a scientific committee who put her remedy to the test of clinical experiment, bought her secret in the year 1739 for 5,000*l.*, and made it public as follows for the benefit of mankind.[1] "My medicines are a powder, a decoction, and pills.

Joanna Stephens

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[1] Extracted by Sir Henry Thompson from the *Gentleman's Magazine*, June, 1739, vol. ix. p. 298.

The powder consists of eggshells and snails, both calcined. The decoction is made by boiling some herbs (together with a ball which consists of soap, swine's cresses burnt to blackness, and honey) in water. The pills consist of snails calcined, wild carrot seeds, burdock seeds, ashen keyes, hips and hawes, all burnt to blackness, soap and honey." The powder was given in drachm doses; the decoction by half-pints. The pills, which were purchased by quarts, were swallowed at the rate of fifty or sixty a day, in weight about two ounces.[1]

Calcined eggshells and soap had been long esteemed as lithonthryptics, as also had most of the vegetable ingredients of her charred and nauseous mess. The essentials of the mixture were lime and soap, or, in other words, lime and potash, since in considering the remote action of the soap we may put aside the oil and have regard only to the alkaline bases, which with Alicant or Castile soap are lime and potash. Thus a powerful alkaline remedy was given in large doses with the effect, as we learn from the cases published by Dr. Parsons, of making the urine alkaline and keeping it so for months. Mrs. Stephens' alkalies did not cure, but it is evident from the published cases that they often much alleviated, and even when they apparently did the reverse they did not fail to encourage the patient by engendering phosphatic sand and grit, which he fondly attributed to disintegration of the stone. After the death of a man (Mr. Gardener) whose supposed cure had helped to make the fame of the medicine and the fortune of the proprietor, no less than nine stones were found in his bladder. These had become sacculated in such a manner as to elude the experienced sound of Cheselden.[2]

Marcet.

In spite, however, of this solution, rather of the doubt than the stone, soap, lime and alkalies continued to be introduced in all shapes, both by the mouth and by the urethra, in calculous affections of every kind. There is still to be seen in the College of Surgeons a large saponaceous mass, which had accumulated in the bladder, as the result of this misdirection of a valuable external application. Subsequently, when, owing in great measure to the researches of Wollaston, the nature of urinary calculi began to be understood, alkalies by themselves came to be extensively used. Dr. Marcet, in the year 1819, pointed out that the alkalies, which he recommended as bicarbonates, could exert a solvent action only upon lithic acid, while phosphatic concretions might be aggravated or originated by their use. He, however, despaired of materially lessening large concretions of any kind in this manner, having regard to the small surface they exposed in relation to their bulk, and limited the use of alkalies to the correction of the uric acid diathesis, the prevention of the increase of existing calculi and the formation of fresh ones, and to such solvent action upon small stones and gravel as might round their edges, and enable them to make easy exit. For practical purposes the problem still stands much as he left it.[1]

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[1] See Parsons on *Lithonthryptics.* London, 1754. Case of Mr. Gardener.

[2] Parsons, *loc. cit.*, p. 236.

Gay Lussac and Pelouze.

The solution of urinary calculi was subsequently investigated, at the instance of the Academy of Sciences, by Gay Lussac and Pelouze, with reference to the researches of d'Etoilles upon this subject. The results[2] were published in the year 1842. Experiments were made upon different sorts of calculi and with various reputed solvents, of which the alkaline carbonates received most consideration. Stones were exposed, even for a year, to solutions containing from 1 to 2 per cent. of the carbonates of potash or soda. None were dissolved; some were not even diminished in bulk. They had lost from a quarter to half their original weight.

In another experiment fragments were exposed for three months to a stream of water holding in solution one-twentieth of its weight of carbonate of soda. The fragments did not generally lose volume, but became friable, and lost from ten to sixty per cent. of weight.

After such experiments, and others upon the living body, in which alkaline carbonates were given as medicine, and passed as injections into the bladder, the Commission reported that, without denying the possibility of the cure of stone by solution in certain cases, they were of opinion that unless the calculi were small they were not likely to be destroyed by agents acting indirectly, as baths or potions, and that as to solvents applied directly by injection, though they acted more powerfully, yet the process was attended with difficulty and danger, not counterbalanced, as in lithotrity, by the prospect of speedy cure. Finally the Commission suggested that the plan might be of use in conjunction with lithotrity, where a large surface was exposed by fracture to the action of the solvent.

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[1] Marcet on *Calculous Disorders*. 1819. P. 152

[2] *Comptes Rendus*, vol. xiv. p. 429.

Prout.

Prout,[1] writing in 1843, spoke hopefully of the solution of stone by medicine, but did not materially add to the previous knowledge of the subject. He believed healthy urine to have in itself a certain amount of solvent power over concretions of lithic acid. Medicinally, in the treatment of such stones he recommended Vichy water, or the alkaline bicarbonates, giving the preference to potash, which he advised in quantities of from one to two drachms a-day, with an equal quantity of tartarated soda. He used these salts in solutions containing an excess of carbonic acid, in which shape he attributed to them a peculiar disintegrating power. He thought that by such means 'an impression might be made' on calculi in the kidney or bladder, but admits that the method is long, tedious, and uncertain. He restricts the use of solvents by injection to the employment of acids in the phosphatic diathesis.

Roberts.

More recently the subject has heen resuscitated by the researches of Dr. William Roberts,[2] which enable us to direct the old remedies with new precision; though it must still be admitted that the dissipation of stones of bulk by agents which have to traverse the general circulation is a matter of hope rather than experience.

After this indication of the steps by which it has been reached, our present knowledge of the subject may be easily displayed, so far as it bears upon the subject of this treatise.

Solution of phosphatic calculi;

Phosphatic stones are soluble in dilute acids. Uric acid, the urates, and cystine are soluble in dilute alkalies. Oxalate of lime is not soluble in anything which the tissues can tolerate, and may be at once excluded from consideration.

With regard to acid solvents, as there is no way of causing the urine to be secreted so acid as to act upon stones, they can only be applied by the urethra and to the vesical cavity. Stones in the kidney are out of their reach. The coats of the bladder will endure a solution of nitric acid strong enough to produce the slow dissolution of phosphatic calculi, and I have seen this means resorted to, though vainly, in the treatment of a concretion of this character which was considered, justly, as it turned out, too large to be dealt with by either cutting or crushing. The cases must be quite exceptional in which this tedious and uncertain method can be preferred to the recognised surgical expedients. It would seem to have its use, as long ago suggested, rather as an adjunct to lithotrity than as a substitute for it. In a case mentioned by Dr. Roberts,[1] the fragments left after the operation were dissolved, and the formation of fresh phosphatic matter, to which there was a great tendency, was prevented by the injection every day, or every other day, of a solution of two drachms of dilute nitric acid to a pint of water. The treatment of vesical stones, however, to which only this method applies, is foreign to the design of this work.

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[1] *On Stomach and Renal Diseases*, 3rd edit. p. 424 *et seq.*

[2] *Transactions Med. Chir. Society.* 1865. 'On Urinary and Renal Diseases,' edit. 2, p. 290.

With regard to stones which remain in the kidney, the question reduces itself, in the present state of our knowledge, to the solvent action of urine, alkalised by the mouth. Solvents can reach renal calculi only by secretion, and those only which are alkaline can be thus conveyed. The stones which we can hope to affect in this way are uric acid, the urates, and cystine; uric acid, as the most common, must be chiefly considered.

of uric acid.

Effects of lime-water.

The belief in the efficacy of lime-water as a solvent for calculi, which prevailed in the last century, with the evidence which was adduced, at least of relief by it, together with the present commendations to the same end, of calcareous waters, make it of interest to look somewhat narrowly at the powers of solution which this earth possesses, and can impart to the urine.[2]

Lime-water out of the body will dissolve uric acid and disintegrate calculi mainly consisting of it, and lead to their destruction more readily, at least, than any of the alkaline carbonates. A piece of uric acid calculus soaked in lime-water, which was frequently renewed, became so friable in three weeks as to break at a touch, while in six weeks it had crumbled so nearly to powder that no fragments remained but such as would have readily escaped by the urethra. Similar portions of the same stone scarcely lost perceptibly in solutions of carbonate of potash and of ammonia; while in carbonate of soda and in carbonate of ammonia they underwent a slight increase of weight. Next to lime water, the greatest disintegration in this experiment was effected by pure water.

Thus, if lime-water could traverse the system as such, and reach the bladder with its properties intact, it would clearly be an efficaceous and safe lithonthryptic as far as uric acid is concerned. But it is sufficiently clear that lime given by the mouth cannot reappear in the urine either as the calcic oxide, or even as the carbonate.

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[1] *On Urinary and Renal Diseases*, 2nd edit., p. 313.

[2] *Essay on the Virtues of Lime Water and Soap in the Cure of the Stone.* By Robert Whytt, M.D. Edinburgh, 1761. Alston's *Materia Medica.* 1770.

The calcic oxide must necessarily form salts in the blood, and thus lose the activity which belonged to it before; while the earth cannot emerge in the urine as a carbonate by reason of the insolubility of that compound. It can reach the urine only as a salt, presumably a phosphate to which we have no reason to attribute any such solvent power as the alkaline earth possesses. But although lime cannot enter the urine in a free state, or as carbonate, it yet has the power of making the urine alkaline, and upon this depends any action it may have upon uric acid. The urine may be made alkaline by lime-water, by the Liquor Calcis Saccharatus, or, more conveniently, by the acetate of lime, which is decomposed in the body, and has much the same ultimate effect as a corresponding quantity of lime-water. The amount of this water needed to make the urine alkaline is, of course, very large, as were the doses given of old—two quarts a day, for example. With the addition of the saccharate the same effect can be accomplished without preposterous dosage. Of the acetate I have found from 2 to 12 drachms daily, according to age and circumstance, effective in making ordinarily acid urine alkaline.

Lime thus given probably leaves the system largely by the bowels, but somewhat with the urine. It may sometimes be noted, however, that the urine becomes alkaline before it displays any increased precipitate with liquor potassæ, or, in other words, before any of the lime so administered has reached it. The alkalescence is due to the potash and soda which the lime has displaced. If the urine, therefore, in such a case has any solvent power, it owes it to these alkalies, not to the lime. Indeed, it is clear, from the reasons I have stated, that the lithonthryptic properties of this caustic earth cannot survive transit by the blood, in which phosphoric acid abounds; but nevertheless it makes the urine alkaline, and thus a solvent of uric acid, whatever the immediate cause of the alkalescence be. But if lime is to make the urine alkaline by the agency of potash and soda, it only does indirectly and with concomitant risk what can be done directly and safely. Lime promotes the formation of the oxalates in acid urine, of the phosphates in alkaline. The alkalies may, indeed, increase the deposition of the phosphates, but not of the oxalate. Lime, therefore, as a solvent of uric acid by the mouth is inferior to the alkalics. If the question were the solution of uric acid by injection into the bladder, lime would be more effective than anything but liquor potassæ, than which it might prove to be better borne. But with lithotrity possible, injection need not be considered.

Contrexeville water.

It is scarcely needful to add a corollary touching the use of calcareous waters, such as those of Contrexeville, which have been vaunted as solvents or expellers of gravel. Contrexeville is a slightly alkaline calcareous water. It contains sulphate of lime in chief (in a proportion of about 1·2 in a thousand parts) with smaller quantities of the carbonates of lime, magnesia, and soda, and other salts. This is drunk at the rate of twenty or thirty glasses a day, with the obvious results of diuresis and sometimes purgation, and the reputed effects of bringing away gravel and relieving gout and vesical catarrh. It may well be believed that scanty urine may be made abundant, over acid urine not so, that gravel may be washed from the pelvis and tubes, and that the salutary consequences of irrigation may be wrought in a system loaded with the products of inactivity and excess; but whether all this would not be better done by some non-calcareous water is a question to be asked. I do not know whether stone is especially common among the natives of Contrexeville, but we know enough of the endemic influence of calcareous water in our own country, to make us cautious in the use of it where a calculous proclivity exists. And it has been already shown that lime-salts taken by the mouth impart no solvent power to the urine which may not be equally given by other means. Lithia is more promising than lime, in respect of the solubility of its carbonate, which appears to reach the urine and act there according to its kind. I shall postpone what I have to say of this earth until after the consideration of potash, with which it may with convenience be compared. Soda must be at once discarded. Urate of soda is a difficultly soluble substance of greater bulk than the uric acid of which it was formed, so that salts of soda may, under certain circumstances, lead to the increase of uric acid calculi rather than their decrease. I found that a fragment of a stone of this nature had added one-seventh to its weight in a week, by a rough incrustation which a solution of carbonate of soda had imparted to it. Hence, soda must be put aside, and with it the numerous waters, with Vichy at their head, which owe their alkalinity to it.

Soda.

Ammonia.

A word may be said in passing as to the action of ammonia. Though this alkali is not secreted by the kidneys when given by the mouth, yet its carbonate is so often present in the urine as a product of decomposition, that its action upon stones is not without interest. Ammonia and its carbonate have in water an effect upon uric acid which is comparable to that exerted by the fixed alkalies and their carbonates—forming an urate which may be either dissolved or left as an incrustation—but in urine ammonia whether free or as carbonate—the carbonate only need be considered—produces such a deposition of the triple or mixed phosphates that any stone which may be present is both increased thereby and protected from any solution that might otherwise be possible. Nevertheless, it may be supposed that if an uric acid stone or part of it be kept clear by friction, a certain amount of solution may in course of time be produced by the ammoniacal products to which itself has given rise, and thus may probably be explained the signs of spontaneous solution which are sometimes to be discerned upon calculi.

Potash.

Dr. Roberts came to the conclusion that salts of potash were more effective as solvents of uric acid calculi than those of soda or lithia, and that of carbonate of potash in particular, the solvent power was up to a certain point increased by dilution, the maximum action upon uric acid belonging to a solution of sixty grains to the imperial pint. With increasing strength the solution was arrested by an incrustation of biurate of potash,[1] insoluble in all but very dilute solutions, which protected the stone from further action. With solutions containing from forty to sixty grains to the pint, there was scarcely any accumulation of this material, as it was removed as fast as formed; with eighty grains there was a loose, with 120 grains, a tenacious coat.

Having ascertained the material and the strength of solutions which have the greatest power of dissolving uric acid out of the body, the next step is to impart to the urine within it the needful amount of the needful substance. The salts which the alkalies form with the vegetable acids appear in the urine as carbonates, a fact which as regards citrate of potash was originally pointed out by Sir Gilbert Blane. With potash, for example, the urine will equally contain its carbonate whether the alkali be given in a caustic state, as bicarbonate, or as tartrate, acetate, or citrate. Of these preparations the citrate appears to create the least disturbance. It may indeed be given in quantity sufficient to keep the urine alkaline for an almost unlimited time without injuriously affecting the stomach or bowels, without causing vesical irritation, without causing the patient to lose weight or strength, or hurting the health in any manner. A man whom I treated unsuccessfully for a presumed uric acid stone in his kidney took a drachm of citrate of potash every four hours for nearly five months, during which time his urine was constantly alkaline. Under the treatment he gained slightly in weight, lost an appearance of anæmia which he had at its commencement, and improved in general health. Slight nocturnal frequency of micturition was the only undesirable consequence which was noticed. From this and many similar experiences, including those afforded by the alkaline treatment of acute rheumatism, it is certain that most persons can take the citrate of potash and other neutral salts of the alkalies in considerable doses, and for a considerable time, without harm.

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[1] See Dr. Roberts on the solvent power of strong and weak solutions of the alkaline carbonates on uric acid calculi. *Report of British Association for* 1861, p. 90.

Lithia. I must here say a word about lithia, which as a lithonthryptic is more encouraging to the chemist than the physician. Dr. Garrod, as is well known, has been led to the belief that this earth is a more active solvent for uric acid than potash, while Dr. Roberts has come to the contrary conclusion. I have made many experiments, in which fragments of uric acid stones have been exposed under the same circumstances to the action of carbonate of lithia and carbonate of potash, and I have found as a constant result that outside the body the earth has dissolved more than the alkali. Among others I may briefly relate three. Of the first the subject was a small stone, nine-tenths of which consisted of uric acid and urates, one-tenth of phosphates. Three similar portions, each weighing ·377 gramme, were suspended each in six pints of liquid, one in distilled water, one in a solution of carbonate of potash, a drachm to each pint of distilled water, one in a solution of carbonate of lithia of the same strength. After nineteen days of the month of June the stone in water was found to weigh ·365 gramme, that in potash ·254, much encrusted, that in lithia ·091, clean and so friable as to crumble at a touch. The water had taken away a thirty-first, the potash a third, the lithia three-fourths. Another experiment dealt with two similar portions of a large stone of almost pure uric acid, each of which weighed 2·775 grammes. One of these was suspended in a solution of carbonate of potash in distilled water, half a drachm to 10 ounces, the other in a similar solution of carbonate of lithia. Both were kept in a water oven at a mean temperature of 100° Fahr.; the solutions were changed every day, but the stones not touched. After four days and nights, the piece in lithia had become so attenuated that the experiment was discontinued lest there should be nothing to show; what remained weighed ·404 gramme, six-sevenths having gone; what was left was uncoated and extremely friable. The piece in potash was covered with a brittle white crust including which it weighed 2·053, having lost a little over a quarter of its weight. In the last experiment to which I need refer, two portions of the same stone as in the preceding were treated similarly in all respects except that they were brushed twice a day so as to remove any crust which might form, as might be presumed to be done within the body by movement. Each piece weighed at starting ·728 gramme. After three days and nights the stone in lithia had been reduced to ·042, and in potash to ·225. The inferior result from the potash thus appears to be due not only to the protecting effect of the crust which forms more abundantly with this agent, but to the superior solvent power of the lithia upon uric acid.

Accepting this conclusion as constant out of the body, we come to the most unsatisfactory part of the question. The salts of lithia, whether carbonate or citrate, are not tolerated in anything like the quantities in which potash can be generally given with impunity, and cannot be suitably employed so as to keep the urine constantly alkaline. Whatever value lithia may have in doses short of this result, it appears that enough to accomplish it generally produces disagreeable consequences—headache, sickness, trembling, and dimness of sight. I have given for short periods as much as half a drachm of the citrate or carbonate every four hours, with the effect of rendering the urine quickly and decidedly alkaline; could we continue the drug in anything like these quantities we might find the solution of calculi within the body practicable, but it is sufficiently clear that such doses cannot be long borne, and indeed it would appear that in ordinary circumstances the alkalinity necessary to the solution of calculi cannot be long maintained by lithia without such constitutional disturbance as would call for its discontinuance.

It must be borne in mind that there are those to whom alkalies of any kind are peculiarly inimical. The class is small but easy of recognition. The disturbances which belong to it, as elsewhere detailed, though often having a superficial resemblance to those in which alkalies are of use, present essential differences to them. The individuals referred to are of nervous temperament, and have one form of what has been called the phosphatic diathesis. The urine, which may be naturally or over acid, but perhaps more often is wanting in acidity, is pale, copious, and gives a bulky precipitate with liquor potassæ in consequence of the excess of earthy, chiefly of lime, salts which it contains. Oxalate of lime and the crystalline phosphate are of frequent occurrence as spontaneous deposits, and if calculi are found they are apt to be of the oxalate or some other earthy salt. Uric acid is seldom thrown down. Lithates, if they occur, are pale, not red. These characters of the urine are conjoined with a sensitive, mobile, and often intellectual character. There is bodily as well as mental activity, and an aspect tending to pallor, or at least not rubicund. Such persons are tremulous, neuralgic, and liable to slight and partial anæsthesia, especially as numbness in the legs. The tongue is apt to be tremulous, and as if boiled, anæmic, uniformly coated, and what is called œdematous. All these conditions are aggravated by mental disturbance, under which the amount of lime in the urine is at once increased, possibly as an evident crystalline deposit. With these persons gout takes an asthenic shape; if they have rheumatic fever it is not with the acute symptoms and acid overplus common to others, or with the same liability to cardiac complications. Thus their diseases do not suggest alkalies, and should such drugs be inadvertently administered their inappropriateness is shown by early alkalinity of urine, the aggravation of any neuralgic symptoms that may exist, the tongue at the same time turning more white, sodden and shaky, and by increasing malaise and nervous prostration. Persons in general, however, and especially those who deposit uric acid, endure alkalies well enough to allow of their free and protracted use. By such means considerable vesical stones have been so acted upon as to show, after their removal from the bladder, evident signs of solution; small ones have, it is believed, been entirely dissolved or reduced to viable size. With stones in the kidney, this amount of success, small as it is, appears to have been seldom attained,[1] though Dr. Ralfe

Occasional intolerance of alkalies.

Results attained.

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[1] *Path. Trans.*, vol. xxxiii. p. 206.

has recently related an instance in which one came away in an attenuated state, owing as was thought to alkalies and soft water. Stones in the pelvis are probably less effectively exposed to the action of the urine than in the bladder. Renal calculi are washed, vesical are soaked. The bladder usually contains urine in which the stones lie more or less completely and constantly exposed to its influence. The pelvis is generally empty, or nearly so, the urine leaving it, except under constrained positions of the body or morbid obstruction, almost as fast as it enters, so that calculi here lodged are only acted upon, and that transiently, by as much of the secretion as trickles over their surface.

Proportions of soluble calculi to others.

The solvent plan must, as has been shown, be practically limited to concretions composed almost entirely of uric acid or urates, or the two together. With this in view it becomes of importance that we should know the numerical chance that the stone is of material thus soluble. The table (page 864) which has been already explained, was compiled with this object. Thence it appears that of ninety-one renal calculi in the museums of London, twenty-one were wholly composed of uric acid, three of urates, seven of uric acid and urates together, and two of cystine. These, thirty-three in number, comprise all, even theoretically, assailable by alkaline solvents. For practical purposes we may exclude the rare cystine stones, the solution of which has as yet received little attention, and regard as amenable to the alkaline treatment, only those calculi which consist of uric acid and the urates. These, as it is seen, comprise almost exactly a third of the whole number. It must be borne in mind, however, that the calculi enumerated were with few exceptions taken from the body after death. They had, therefore, had the utmost time to gather phosphates and remove themselves from the class of soluble stones. It is probable that, at an earlier period, a few of them may have consisted wholly of uric acid and been possible subjects for solution. But it is evident from the fact that the compound calculi have more often a nucleus of oxalate of lime than of uric acid, that the number at any time soluble by alkalies never could have amounted to one-half. It may be observed that thirty-nine of the ninety-one calculi which contained either a phosphatic deposit or carbonate of lime, had necessarily been associated at some period of their growth with alkaline urine, and were therefore not only insoluble in alkalies but were liable to derive fresh accretion from alkalisation. It will be readily inferred that the cases of renal calculi amenable to alkaline treatment are proportionately few. The stone must be of pure uric acid, or at least must contain no admixture but urates. It must also be of small size. If the urine be alkaline, it may be presumed that a phosphatic crust exists, and all such cases must be discarded. If the stone be of long standing, a similar condition must be suspected, notwithstanding that the urine retains its acidity, and a similar encasement must also be apprehended, should the urine contain much pus or mucus of renal origin. If oxalate of lime habitually exist in the urine, it may be presumed also to occur in the stone, and must also contra-indicate solvent remedies.

In the absence of all these prohibitions, perhaps the least hopeless subjects are children. Uric acid concretions occur especially at an early age, and when crystals are habitually passed it is often easy to arrive with some confidence at a belief that there exists a small renal stone of this nature. With children the stone, necessarily recent, is probably small and simple.

Given a suitable case, citrate of potash must be accepted as the best material for charging the urine with the desired carbonate; the dose to impart the greatest solvent effect is for the adult, as Dr. Roberts has shown, from 40 to 60 grains every three hours, in 3 or 4 ounces of water. Two conditions may arrest the solvent process.

Rules for the administration of potash.

If the urine become ammoniacal the treatment must be discontinued, as then the mixed phosphates will be apt to be deposited as an insoluble crust. It is beyond question that by this state of urine stones have often been increased and multiplied. Secondly, it is needful to guard against a too great alkalinity of urine from fixed alkali, since, as has been shown, under this influence the stone may become incrusted with the insoluble alkaline biurate. Thus dangers of two kinds lie in the direction of over-alkalinity. It is safer to give too little alkali than too much.

It is a matter of common experience that the symptoms caused by the passage of uric acid gravel receive marked and speedy relief from alkaline solutions, but I have never been successful in removing by such means the signs of a stationary renal concretion. In cases where unmistakable symptoms of stone in the kidney have been associated with highly acid urine and the habitual passage of uric acid gravel, so that the nature of the concretion was scarcely more doubtful than its position, I have kept the urine alkaline with potash for periods varying from two to five months. Under such treatment, without injury to the general health, the local symptoms have mitigated, but they have never disappeared. The benefit has declared itself in a diminution of pain, with increased tolerance of rough locomotion and improved power of walking. A lady whose walks had been restricted to a mile a day by pain in the loin, leg, and foot, attributed to a concretion of uric acid in the left kidney, became, under alkalies, able to walk four miles with no more inconvenience, and she subsequently endured much rough travelling with little annoyance, which it was thought she could not have done previous to the treatment. Beyond such alleviation of symptoms my success in the solution of calculi has not gone.

Conclusions.

To sum up, the solution of stones whether in the bladder or kidney, is not yet within the range of practical medicine. Lithia is not well borne; potash out of the body in the most favourable circumstances acts slowly; within the body, there is the uncertainty as to the nature of the stone, and the suitability of alkaline treatment. When in the bladder, any such tedious and worse than uncertain method can never be opposed to the operation of lithotrity, though when it is impracticable, or as an adjunct to it, acid injections may find the use which has been assigned to them. As to the kidney, enough has been said to show that no methods which have as yet been tried are substantially effective: if the solution of calculi is ever to be accomplished it must be from a new departure.

CHAPTER XV.

MISPLACEMENT, DISPLACEMENT, AND MOBILITY OF THE KIDNEY.

MISPLACEMENT.

BEFORE considering the movable kidney, which may either be congenital or acquired, a word may be said about congenital misplacement of the organ so far as this condition is capable of clinical recognition or has practical importance. The common horseshoe fusion of the two kidneys hardly comes within this description, but one kidney has often been found to be misplaced downwards, either upon the lower part of the vertebral column on its own or the opposite side, often upon the sacro-iliac promontory or the sacro-iliac synchondrosis. The organ has been found in one of the iliac fossæ, or partially or entirely within the pelvis. It appears that the development of the renal structures commences in front of the bifurcation of the aorta, and that the ordinary misplacement of one of these organs is due to its retention in or near its original situation. The misplaced organ usually presents itself as a post-mortem surprise, though its situation is often such that it could not fail to have been felt as an abdominal tumour had there been any symptoms which suggested palpation of the abdomen. The kidney thus out of place has indeed been so recognised, and in one instance extirpated in circumstances which will be presently referred to. A gentleman, aged 45,[1] whose case is related by Mr. Durham, had an attack of fever, during

Common positions of misplaced kidneys.

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[1] Paper by Mr. Durham 'On Misplacement and Mobility of the Kidneys,' *Guy's Hospital Reports*, 1860, p. 108.

convalescence from which a swelling was noticed in the hypogastric organ, somewhat to the left of the median line; it was oval, elastic and fixed, not nodulated, nor did it present any distinct elevations or depressions. Manipulation caused disagreeable sensations, but not acute pain. No conclusion was arrived at as to the nature of the tumour. Five years later it was exposed, *post mortem*, and found to be the left kidney, which was situated over the sacro-iliac synchondrosis and extended somewhat on to the promontory of the sacrum, and also by its lower part into the true pelvis. The colon formed no sigmoid flexure in the left iliac fossa but passed across the median line, and the commencement of the rectum was on the right side of the sacrum. The kidney was partially divided into three lobes. Four ureters left it, which shortly united into one; there was no distinct hilum, and consequently not the characteristic kidney shape. The organ received three arteries, the largest from the aorta near the bifurcation, a branch from the right common iliac, and one from the left internal iliac. The supra-renal capsule was in its normal position.

Clinical consequences.

The misplaced kidney has been known to form an impediment to labour, as in one instance quoted by Rayer, in which it was found after death deeply situated on the inner side of the psoas muscle.[1] Two children had been borne; with the delivery of each a tumour was recognised on the left side of the pelvis, which became painful with each contraction of the uterus and retarded the passage of the head.

Congenital misplacement of the kidney is in a considerable majority of instances of the left, and in the male sex; acquired dislocation or mobility chiefly affects females, as will presently be seen, and the right side.

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[1] Rayer, *loc. cit.* vol. iii. p. 774.

DISPLACEMENT AND MOBILITY.

The kidney is apt to be displaced or to become movable as the result either of acquired or congenital states. It is sometimes completely surrounded by peritoneum, the folds of which meet behind, like those of the mesentery, forming what has been termed a *mesonephron,* which may allow so much liberty of movement that the organ may be immediately beneath the abdominal wall or elsewhere, far from its proper position. In other circumstances the kidney becomes loosened in its bed, so as to be capable of being moved within it, but within which its movements are limited.

General relations.

It is ordinarily covered by the peritoneum, but not embraced by it, nor, putting aside a long anchorage from the hilum, is the organ fixed in the interval in which it lies otherwise than by the cohesion of the areolar tissue around it. A temporary increase in the size of the gland can easily expand the enclosure which it occupies, so that this, when the enlargement has subsided, is too wide for the structure within; or any force brought to bear upon the organ may cause it to split its encasement in one direction or another, and thus come to occupy a cavity which is too large for it, and within the limits of which it can move. In the first of these circumstances the kidney may float; in the second, without floating, may become movable. The movable and the floating kidney may be distinct in origin and nature, the movable kidney an acquired, the floating a congenital state, or they may be merely different degrees of the same condition: the peritoneum may become loose enough to enfold the kidney and meet behind it, much as though the mesonephron had been an original structure.

The displacements of the kidney thus described have no tendency in themselves to cause death, and are far more often met with during life than afterwards; nevertheless they have been exposed with sufficient frequency to give a pathological foundation to our clinical knowledge. I believe that acquired mobility of the kidney is more common than it is generally supposed to be. I have notes of eleven cases of it which I have seen during the last five years.

Subjects.

The movable kidney is usually found in women, and on the right side. Roberts estimated that of 70 cases 61 occurred in women, 9 in men; Ebstein, that of 96 cases 82 were in females, 14 in males. To these I may add 12 cases of my own, as yet unpublished, of which the subjects were females in 10 cases, males in 2. As to age, the disorder is exceedingly rare in childhood; the earliest instance I have seen was in a girl of 10, in which mobility was associated with, probably, congenital displacement. Instances have been recorded at the ages of 8, 7, and 6 years. In a large majority of cases the peculiarity presents itself in early adult and middle life, coincidently with the period of child-bearing, and the frequency of accidental violence.

It has been said that the subjects of the movable kidney are always thin, a statement by no means consistent with my own experience. I have seen it most often in women with large, loose abdomens, often inclined to corpulency.

Side affected.

With regard to the side affected Ebstein—to quote his enumeration as the latest and largest—found that of 91 cases, the right kidney was affected in 65, the left in 14, both in 12. Among the 12 instances referred to 10 belonged to the right kidney, 2 to the left.

Sometimes congenital.

The condition is usually acquired after birth, though sometimes the result of a congenital peculiarity of the peritoneum. Mr. Durham[1] reports a case in which this membrane presented an abnormal arrangement which was associated with malposition of the colon. In this instance the affected kidney, which was the left, could be made, after death, to pass from its proper position into the left iliac fossa, and also across the spine, somewhat to its right side.

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[1] Durham, *Guy's Hospital Reports*, 1860, vol. vi. p. 413.

It once happened to me to observe in the course of the post-mortem examination of a person in whom no renal symptoms had attracted attention, that the layers of peritoneum met behind one kidney, forming a complete mesonephron about an inch and a half long, to the extent of which the organ enjoyed free play. This arrangement, of which several similar examples have been recorded, was probably congenital. As to the acquired conditions, the organ has been known to have been displaced downwards, in connection with a hernia which involved the cæcum, possibly dragged down by the descending bowel. Usually the state found is mere looseness of the peritoneal covering by which, together with the structures which enter the hilum, the kidney is held in place. The amount of mobility varies much; the gland usually slipping down for an inch or two under pressure or change of posture, sometimes moving, as in a case referred to in the 'Pathological Transactions,'[1] within a circle having a diameter of eight or nine inches. The kidney itself has in most cases been found to be healthy, though sometimes its condition and environment show changes which account for its peculiarity, and sometimes alterations which are subsequent, and possibly consequent, upon it. A deficiency of the circumrenal fat has been often noticed, and the mobility of the organ found to follow upon rapid emaciation. An instance in which the organ had probably thus become loosened in its bed by losing its packing has been reported by Dr. Jago,[2] and others of the same sort have been recorded.

Generally acquired.

Pathology.

Mobility of the kidney has been associated with pyelitis, as in an instance within my own experience to which I shall presently refer.

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[1] Report of Committee on Displaced, Movable, or Floating Kidneys, *Path. Trans.* vol. xxvii. p. 467.

[2] *Medical Times*, September 1872, p. 329.

Dr. Sawyer[1] relates the case of a woman who died at the age of thirty-five with symptoms of a right movable kidney and pyelitis. She had had seven children, and for six years had had pain and frequency in passing urine. Latterly the urine had contained much pus, evidently of renal origin. She died of acute peritonitis. The right kidney which lay between the umbilicus and the anterior superior spine of the ilium was riddled with abscesses, and the ureter dilated and thickened. We have no evidence of the cause of the pyelitis in this case, or whether it preceded or followed the mobility, but the fact of the association is of interest. The same concurrence is to be seen with hydronephrosis, as in one instance related by M. Fritz.[2] A woman of the age of thirty-three, who had long had pains in the right iliac fossa, was found to present an oval tumour in this region which had the character of hydronephrosis. The tumour, which extended from the lumbar to the umbilical region, was movable in all directions. After a time a calculus was passed and the tumour much diminished, still remaining movable.

Another instance of a similar association is related in the same paper from the experience of M. Urag. A woman who was the subject of bronchitis was found to present a reniform tumour in the abdomen below the anterior border of the right lobe of the liver. This moved with respiration, and could be displaced towards the median line, towards the right lumbar region and slightly downwards. Manipulation caused considerable pain. After death it was found that the tumour was the right kidney, which was attached by old adhesions to the liver, the gall-bladder, and the transverse colon. The organ was hydronephrotic, the ureter being occluded, in consequence of 'engorgement' of the posterior wall of the uterus. In the latter case the condition was complicated by the adhesions which occurred in the course of the disease; but in both it is probable that the essential cause of the mobility was the alternation of bulk which the condition of hydronephrosis generally involves.

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[1] Paper on 'Floating Kidney,' by J. Sawyer, M.B., *Birmingham Medical Review*, 1872, vol. i. p. 120. See also report by Dr. Hickenbotham, *Brit. Med. Journ.* December 24, 1870.

[2] Paper by M. Fritz on 'Floating Kidneys,' *Archives Générales de Médecine*. 1859, vol. ii. p. 168.

Whether associated with pyelitis or hydronephrosis, there is not infrequently a history of calculus or gravel in connection with the movable kidney accidents which particularly tend to cause the variations of bulk which are so apt to loosen its attachments.

To complete the morbid anatomy of the condition before further discussing its mode of origin, the kidney, though usually healthy, has been found to have become affected in various ways, either consequently upon its mobility or independently of it. The most common change is perinephritis, as indicated by peritoneal thickening, and occasionally by adhesions to the neighbouring organs —especially the liver. The frequency of pyelitis in this relation suggests that the inflammatory state may occur not only antecedently, but also as a consequence of the mobility by means of the constriction of the renal outlet which the shifting must often involve. The displaced or movable kidney is not thereby exempted from other chances of disease. It has been found to be granular, as in an instance related by Dr. Coats.[1]

Etiology.

The causes of the condition are in great part explained by its morbid anatomy. Loss of bulk, whether in or about the kidney, whether the escape of an accumulation from the pelvis whereby the kidney shrinks so as no longer to fill its bed, or loss of the surrounding fat so that its bed becomes too large for it, has been sufficiently dwelt upon in connection with its origin. It remains to add what is needed to make the tale complete. The kidney appears to be often displaced by external pressure or violence. The leading facts in the distribution of the peculiarity, its frequency with women and on the right side, may point to the influence of pregnancy, of tight lacing, and of the pressure of the liver. It has been observed that movable kidneys are most often found in women who have borne children, and that after delivery the abdominal muscles are lax, and the viscera comparatively unsupported. Of twelve cases of movable kidney under my own observation, the subjects of nine were women who had had children, though one of these attributed her disorder not to pregnancy but to severe and repeated exertion in lifting a sick husband, and another to a fall upon the right lumbar region. One of my patients (p. 1042) became aware of the mischief upon recovering from chloroform, which had been given during labour; another (p. 1041) attributed it to violence used in the extraction of the placenta by an inebriated accoucheur. The condition has been somewhat doubtfully attributed in the same sex to a hyperæmic swelling of the organ, supposed to occur at each menstrual period and subside with it. Tight lacing by which the liver is pressed down upon the right kidney has been assigned as a cause of its becoming loosened and displaced; and the same result has been with more certainty traced to strains and falls and other violent injuries. It has been said, though my own personal experience scarcely bears out the statement, that movable kidneys are proportionately more often met with among women of the working class than amongst those in easy circumstances, with whom tight lacing is more common.

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[1] *Path. Trans.* vol. xxvii. p. 469.

A gentleman under my care, whose case will be further referred to, attributes the peculiarity which affects the right kidney to repeated falls in hunting. An instance is related[1] in which the left kidney became thus movable in consequence of a fall upon the ice, and another in which both became so after a fall from a horse. A labourer[2] over whose loins a cart passed was found by Dr. Yeo to present afterwards the signs of movable kidney.

Signs

With regard to the clinical aspect of movable and displaced kidneys the latter, so far as congenital malposition is concerned, need no further notice than has already been given them. Movable or floating kidneys, however, have much importance from this point of view. They are to be recognised by the presentation of a tumour of renal size and shape in a position not belonging to the kidney, from which, under pressure, it withdraws itself in the direction of the proper renal region. The peculiar slipping of the movable kidney under the influences of pressure and position at once distinguishes it from every other abdominal tumour ; it moves like the testicle in the

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[1] Roberts, *loc. cit.* 3rd edition, p. 614.

[2] *Brit. Med. Journ.* June 6, 1874, p. 744.

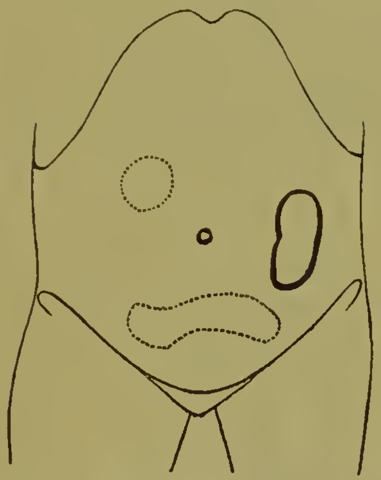

Fig. 1.—Misplaced left kidney with two fæcal masses (Emily Marshall, page 1032).

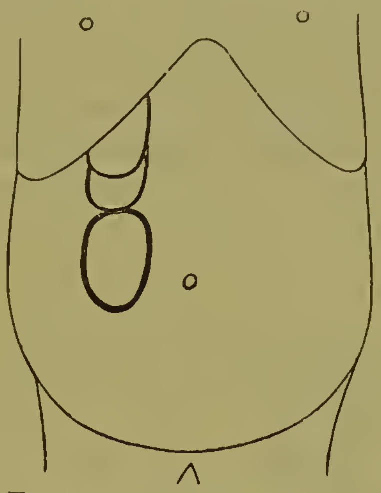

Fig. 2.—Movable right kidney in a man (page 1036).

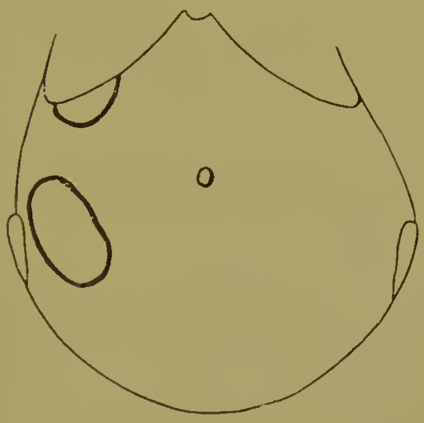

Fig. 3.—Movable right kidney in a woman (T. Edwards, page 1039).

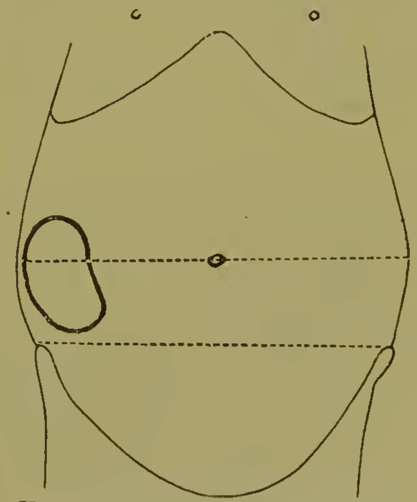

Fig. 4.—Movable right kidney in a woman (C. Roberts, page 1042).

scrotum or a pea in its pod. The organ emerges from the depths of the hypochondrium, commonly the right, to present itself as a tumour tangible from the front or lateral aspect of the abdomen. The position of the tumour has a wide range: it may not descend further than as if the lower end of the kidney protruded from under the edge of the ribs, or the organ may pass as low as the umbilicus or even into the iliac fossa and occupy almost any part of the space between the lateral limit of the trunk and the median line, which boundary, indeed, is sometimes partially crossed by the erratic mass. The lump suddenly presents itself from under the ribs from the effect of bodily movement—the patient possibly turning on the side on which the movable kidney is not—or of deep inspiration, perhaps undertaken with the purpose of displaying the condition. The rounded and reniform mass may then be more or less grasped, and made by directed pressure to hastily withdraw itself in the direction whence it came, gliding at once out of reach, giving to the fingers a sensation as if it were slippery. When the organ descends, its absence can be detected from the lumbar region by hollowness and comparative resonance. The

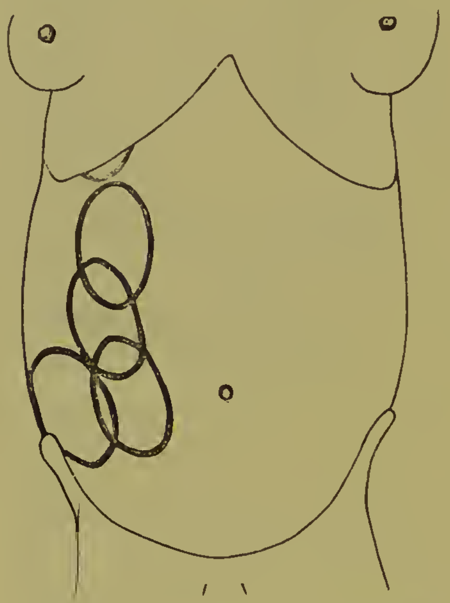

Fig. 5.—Right kidney extensively movable (Minnie Holloway, page 1041).

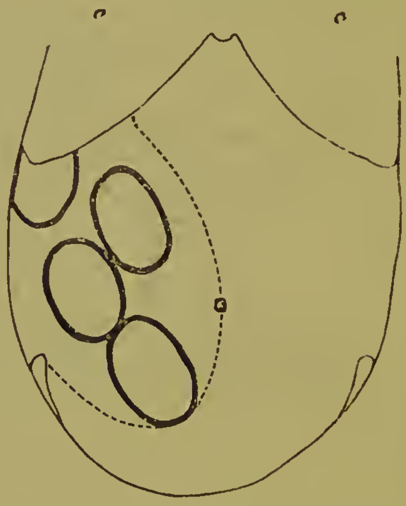

Fig. 6.—Right kidney extensively movable (Mrs. D——, page 1043).

displaced kidney may be near the surface, though usually not so superficial but that bowel resonance can be detected over it. The pulsation of the renal artery has been felt, though the mass is seldom sufficiently superficial to allow of this. Sometimes it is very deep, only to be reached by somewhat forcible palpation, and even may be distinctly recognisable only when the abdominal resistance is overcome with chloroform. Pressure on the organ usually gives rise to a sickening sensation.

and symptoms.

The shifting may be quite or nearly without discomfort, or may be attended with much pain and intestinal or nervous disturbance, symptoms which are probably largely due to the tension or forced flexure of the nerves which enter the hilum.

The pain is often described as of a dragging character. It chiefly accompanies displacement of the organ, though in some cases always present more or less. It is aggravated by movement and relieved by lying down. It stretches from the lumbar region to the tumour, which is apt to become tender, and often shoots in various directions, into the testicle or labium and down the thigh. I have known a patient so suffering to have severe pains of a neuralgic character in parts of the body not locally connected with the affected part.

Paroxysmal attacks,

The pain of the movable kidney has been observed, as with a patient of my own, to become aggravated at the monthly periods, and the displaced organ thought to swell. A peculiarity of the disorder is the occurrence at irregular intervals, and often without any obvious cause, of severe attacks of pain with constitutional disturbance, not unlike fits of renal colic. The displaced organ swells and becomes exquisitely tender, and cannot be replaced. There is intense pain in its neighbourhood, together with shivering, sickness, and prostration. With a lady under my care, whose case will be further referred to (p. 1038), the attacks recurred about every five or six days, each lasting ten or twelve hours. The pain was described as very severe, passing through the abdomen under the liver to the spine. These were attended with vomiting and extreme prostration. They subsided under the influences of morphia and rest in bed. These seizures have been thought to depend upon retention of urine in the pelvis, owing to some twist or compression of the renal outlet, but the evidence of this is incomplete, and indeed with the remarkable toleration of obstructive suppression when it affects only one kidney we can scarcely assign the severe and sudden symptoms which have been described to this origin. It has been supposed with more probability that a sharp bend or twist of the renal vein, with consequent congestion and swelling of the organ, is more particularly concerned in the production of these paroxysms; at the same time it must be allowed that their symptoms apart from the swelling, the pain, vomiting and prostration, show at least that the nerves are closely implicated in the passing disorder, even if not its primary cause in some mechanical manner connected with dislocation.

affecting the bladder

Vesical irritation and frequency have occasionally[1] been noticed. A gentleman who applied to me with a movable kidney had, at the time of its appearance, symptoms which were attributed to cystitis. When I saw him some weeks afterwards I found that the urine was phosphatic but free from pus; I presumed that the irritation might have been purely of nervous origin. Various forms of bowel disturbance are frequently noticed in connection with the condition. A gentleman under my notice who had a movable right kidney found that occasional diarrhœa was the chief trouble it caused. The diarrhœa was connected in sensation with the movable organ, and was always brought on when by increased bodily movement or mental excitement the pain in it was made worse. In a case mentioned by Dr. Roberts, also of a movable right kidney in a man, there was much irritability of the bowels, associated with dragging pain in the situation of the kidney and ascending colon. Constipa-

and bowels.

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[1] Fritz, *Archives Générales de Médecine*, 1859, vol. xiv. p. 171.

tion and fæcal accumulation have also been found. A girl of 10 years old under my care had a misplaced kidney which lay near the surface of the belly to the left of the umbilicus. She had at the same time a number of superficial lumps in the abdomen, which were removed by purgatives and no doubt were fæcal. An instance is recorded by Dr. Johnson[1] in which accumulation of the same nature had similarly resulted.

Results of pressure.

A displaced right kidney has been known, as in an instance recorded by Girard,[2] to compress the vena cava and cause œdema of the right lower limb. Jaundice has been produced by the compression of the common bile-duct by a dislocated kidney, which was in contact with the transverse fissure of the liver[3] and adherent to the duodenum.

State of urine.

The kidney may be diseased independently of its displacement, but, putting this aside, the only urinary changes proper to this condition are such as give evidence of pyelitis. When this complication is not present the urine is natural. Evidences of pyelitis, possibly only microscopic, scales of epithelium, presumably from the pelvis, and perhaps a few pus-globules, are found more often than not with such cases, while in some the urine is abundantly purulent, showing a high degree of the same inflammatory state. It is clear from what has been already stated that some conditions associated with pyelitis may precede and cause the mobility, but it is no less probable that the necessary distortion of the pelvic outlet may in some cases prevent the free escape of urine, and thus produce results due to its retention.

Diagnosis.

The diagnosis of the condition presents little difficulty; the peculiar mobility is pathognomonic. A movable kidney has been mistaken for the spleen, and frequently for a morbid growth within the abdomen.

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[1] *Med. Times*, October 1859, p. 426.

[2] *Journal Hebdomadaire des Progrès des Sciences Médicales*, 1836, vol. iv. p. 445.

[3] *Brit. Med. Journ.* January 29, 1876.

Women who have had them have been known to persist that their movements were those of a fœtus *in utero.*

As the disease has little tendency either to shorten life or to get well, its duration is absolutely indefinite. Among 11 cases under my own observation, where the date of beginning was noted, was 1 in which the condition had lasted for thirteen years, 1 for six, 3 for five. Dr. Jago[1] mentions one instance in which it had been present for twenty-three years.

Duration.

Death usually occurs from some cause unconnected with the state of the kidney, though where it has been associated with pyelitis a fatal issue has been brought about by this complication. A woman[2] under the care of Dr. Hickenbotham, whose case has already been referred to, had a floating right kidney, together with pyelitis, as evinced by the passing of pus, blood, and phosphates with the urine. Fourteen days before her death she was seized with pain in the movable kidney, which she had not had before, followed by symptoms of peritonitis. It was found that, in addition to general inflammation of the peritoneum, the right kidney was riddled with abscesses, and its ureter dilated and thickened. The peritonitis had probably been produced by the renal suppuration, that by the pyelitis. No cause appears for the pyelitis besides the displacement.

Termination.

The medical treatment of the condition essentially consists in the replacement of the organ, its retention in its proper position, and the relief of the pain to which its displacement gives rise. A simple and often sufficient measure of relief is the recumbent posture. The avoidance of riding on horseback, and all rough exercises and modes of locomotion, and straining at stool, is no less obvious. A woman, whose case is mentioned by Dr. Hare,[3] lost her symptoms almost entirely under the influence, as was thought, of two successive pregnancies, the enlarged

Treatment —medical.

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[1] *Med. Times*, September 1872, p. 328.
[2] Paper by Dr. Sawyer, *Birmingham Med. Review*, vol. i. p. 120.
[3] *Med. Times*, January 1858, p. 112.

uterus supplying the needed upward pressure. Artificial support by means of a belt or truss has often been used with advantage. For a lady, whose case is related at page 1038, who suffered from severe and frequent paroxysms of pain, connected with a movable right kidney, I had a truss constructed with a powerful spring, of which one end rested on the spine, the other pressed a conical pad, with a spiral spring, deep into the right hypochondrium. This instrument proved so effective that whereas the attacks formerly recurred every five or six days, after its application the lady passed six months with only one, which had been brought on by exceptional exertion. The objection to a truss is the inconvenience of the necessary pressure.

A less uncomfortable measure, but one which is found in some cases to suffice, is a broad elastic belt, fitted to the shape, with a firm pad upon the hypochondrium. I have at present five patients who wear with advantage renal supports, three trusses, two bandages.

Dr. de Mussy arranged, with benefit, that a lady, whose right kidney had become loose, should have an action of the bowels every evening, and before rising in the morning—that is, before the organ had become displaced by movement—should slip upwards over the lower extremities an elastic bandage, to which a horse-hair pad was so fixed as to press in front of the affected lumbar region.

The urgent paroxysms of pain and vomiting which are sometimes attributed to strangulation of the ureter, but which are more probably due to stretching or twisting of the nerves or veins, are to be treated with absolute rest and morphia, the replacement of the organ when this can be accomplished without violence, and such measures as leeching and fomentation, should symptoms of local peritonitis present themselves. The attacks usually appear to be of brief duration.

Importance must be attributed to the regulation of the bowels; while the anæmic, hypochondriacal, and neuralgic conditions so common with the disorder call for ferruginous medicines and others of the tonic class.

Pyelitis, gravel, or phosphuria may call for appropriate modifications of the treatment should these complications present themselves.

Surgical excision.

Regarding the movable kidney, as we must, not so much as a danger as an inconvenience, and an inconvenience which can be mitigated almost to nothing by safe and painless measures, it can seldom be justifiable to risk life in search of cure. Nevertheless, kidneys in this state have been removed often enough to enable us to measure with some accuracy the death-rate of the operation.[1] Martin, of Berlin, states that he has excised a floating kidney in seven cases, with the result of four cures and three deaths. He always cut from the front through the peritoneal cavity. The operation was once performed by Meckel,[2] also from the front, with a fatal result, and by Smith, of New Orleans, from the loin, with a favourable one. Thus with nine excisions there were four deaths. Dr. Harris, of Philadelphia, in a recent collection of one hundred cases of extirpation of the kidney, includes sixteen in which floating kidneys were thus treated.[3] Putting aside one in which the removed organ was the seat of sarcoma, and the result fatal, there were five deaths to ten recoveries, surgical enterprise having thus provided a considerable mortality for a disorder which of itself has little or none. A startling case is reported by Dr. Polk, of New York, in which a painful tumour in the left iliac fossa, which was supposed to be what it ultimately proved, a misplaced left kidney, was removed from a young woman in whom, as had been ascertained, the vagina and uterus were absent.[4] The patient survived the operation for eleven days. It was afterwards found that the kidney of which she had been thus deprived was her only one. No trace could be found of any structure corresponding with or belonging to the right kidney. It is to be observed that the left kidney is more often the subject of congenital misplacement than the right, which fact, together with the other congenital defects which were found, might have suggested some uncertainty as to the rest of the organism. My personal experience of the excision of movable kidneys amounts to my having successfully advised against it in several instances. There are conditions of suffering in which life may be properly endangered in search of cure. That belonging to the movable kidney may be one, but we have to ask whether there are not safer means of relief?

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[1] *Trans. of the International Med. Congress*, vol. ii. p. 278.

[2] Paper by Mr. Barker, *Med.-Chir. Trans.* vols. lxiii. and lxiv.

[3] 'Tubular record of 100 cases of extirpation of the kidneys,' by R. P. Harris, M D., *American Journ. of Med. Science*, July, 1882.

[4] 'Case of extirpation of a displaced kidney.' by W. M. Polk, M.D., *New York Med. Journ.* February 17, 1883.

Fixation.

As an apparently less formidable operation the movable organ, or rather its capsule, has been fixed by sutures to a wound in the loin, upon the healing of which it has been found that the kidney has been soldered to the side by granulations and cicatricial tissue, so as to be no longer movable. The present experience of this operation, *nephroraphy*, as it has been termed, is small; it has been performed some seven times without death, and generally with benefit.[1] It would appear that surgical enterprise in regard to the movable kidney is more promising in the direction of fixation than removal; further than this it would not become me to express an opinion.

The following cases may serve to present the more ordinary clinical aspects of misplaced and displaced kidneys:—

Misplacement of kidney, probably congenital, associated with fæcal accumulation.

Emily Marshall, ten years of age, was admitted under my care at the Hospital for Sick Children, September 6, 1877. Since the previous March she had pain in the abdomen about the region of the navel, not regularly but off and on, especially at night. The belly was noticed to be swollen and hard, and the child became listless. In July, a doctor was consulted, who stated that she had enlargement of the spleen and dropsy, and administered without advantage medicines which were followed by severe purging and salivation. When she came into the hospital she had much the general aspect of health; there was no sign of dropsy. The abdomen was rounded, full, and inelastic, and presented three tumours, two of which were somewhat indefinite in outline, the third more distinct. They were not quite dull on percussion, but had the muffled resonance of solid masses lying on the intestines. One of these, about 2 inches in diameter and circular in shape, was placed in the nipple line about midway between the level of the umbilicus and the edge of the thorax; another, this being the more definitely circumscribed, had an ovoid shape with the long axis vertical, occupied the corresponding position on the left side, and had dimensions which will be presently stated. The third lay transversely across the lower part of the abdomen, between the umbilicus and the pubes. The upper of these masses (see fig. 1, p. 1023) were quite distinct in position from the liver and spleen, and the suspicion at once occurred that they were fæcal accumulations; a suspicion which was justified as regarded two of the masses by their gradual but complete disappearance under a succession of enemata, alternated with purgatives by the mouth. The mass on the left remained unaltered, and presented the outline represented in the diagram. This remained unchanged by purgatives continued long after the other lumps had gone. It was freely movable from side to side, lying sometimes under the umbilicus, sometimes considerably outside the position indicated. It was commonly placed 2 inches from the spine of the ilium, the same distance from the navel, and at such a level that its centre was slightly lower than that point. The tumour was almost exactly the size and shape of the kidney; it measured 2⅜ inches in the long diameter, 1½ inches across. A depression could be felt on the inner side corresponding with the hilum. The tumour was not absolutely dull, though less resonant than the rest of the abdomen. It felt near the surface, and could be readily slipped about with the fingers. It was not at first evident whether the degree of resonance it possessed was due to bowel before it or behind it. To determine this point the child was put under chloroform, and the bowel injected with air; this appeared to pass behind the tumour, which was lifted up with the distension of the abdomen. The test failed to reveal the presence of intestine between the surface and the questionable mass.

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[1] *Centralblatt für Chirurgie*, July 23, 1881, and July 22, 1882. Cases by Hahn, Esmarch, and Küster. Paper by R. W. Wier, M.D., *New York Med. Journ.* Feb. 17, 1883. Case by D. Newman, M.D., of Glasgow, *Brit. Med. Journ.* April 28, 1883. p. 831.

The left lumbar region was more resonant than the right, as if the kidney were absent from its normal situation, but no difference in resistance could be detected.

The child was long under observation, during which the tumour remained unchanged, and herself in perfect health. The urine was always natural.

The proof that the tumour in this case was renal is not absolute, though, taking into consideration its shape, size, and persistence, the general health of the child and the difficulty of suggesting any other explanation, the probability that it was of this nature is strong. In this view the misplacement would probably be congenital; the kidney one to which a mesonephron was attached, and whose relation to the colon was abnormal. The concurrence of fæcal accumulations with a misplaced or displaced kidney is an experience, which has been already adverted to.

The following is an example of the connection of mobility of the kidney with distension :—

Mobility of kidney associated with pyonephrosis.

In November 1881, I was asked by Dr. Coffin, of Haverstock Hill, to see with him a widow lady who was passing large quantities of pus with the urine. She had had several children, the last six years back. There had been no peculiarity with any of the confinements, no renal symptoms with these or with pregnancy, nor was there any history of stone, gravel, or hæmaturia.

About two years before I saw the patient a tumour was found in the left side, which was thought to be partly fæcal, and purgatives employed, with the result as was thought of reducing it. But there still remained a mass which filled the space between the thorax and the pelvis on the lateral aspect of the body, and was supposed, no doubt correctly, to be renal. After a time this got smaller, and then was found to be movable, slipping up under pressure, so as to be partially covered by the ribs, and readily falling down again. The urine at this time contained pus to about a quarter of its bulk, was constantly acid, and free from blood.

I found a tumour which filled the lateral aspect of the abdomen, and extended into the lumbar region, filling up the lumbar hollow. When she turned on the right side the mass fell forward about 2 inches; it was very tender, so that its upward mobility could not be put to the test. Both loins were tender, the left especially so. Jolting, walking, or much movement caused pain in the tumour. There was tenderness in the vesical region above the pubes, and frequency of micturition, urine being passed six or eight times every night in correspondingly small quantities. The bladder had been sounded but no stone found. The urine contained much pus, evidently of renal origin. It readily separated from the urine, which was clear, pale, and acid. There was no albumen beyond what the pus would account for, nor any mucus of vesical character.

The case was clearly one of pyonephrosis, probably of calculous origin; the mobility an accident due to consequent changes of renal volume.

I saw this lady again in June 1883. She was in much better general health and less pain. Her chief trouble was now frequency of micturition. The urine was almost free from pus, none being visible to the naked eye, though globules were still to be detected with the microscope. There was a large, nearly globular, mass which lay in the renal position, extending from the edge of the thorax to that of the pelvis, which with firm and gradual pressure could be made to ascend and lose itself under the ribs. It was probable that this kidney, formerly the source of the pus, had become closed and comparatively quiescent. The handling which was now practised with impunity could not have been borne formerly. The patient was advised to keep the organ from falling by means of a belt and pad, such as is referred to in the case of Holloway (p. 1041).

Mobility of right kidney first noticed five months after protracted labour.

Jessie A———, aged twenty-six, married, with one child, was admitted into St. George's Hospital, under Dr. Barclay, February 28, 1877. Seven years before she had been naturally delivered, but after a protracted labour, followed by much hæmorrhage; five months afterwards she was suddenly attacked with pain in the right side of the abdomen, headache, and vomiting, and found a tumour at the seat of pain, which was stated to have increased in size until a year ago, and then remained stationary. During the first five years the attacks recurred at intervals of three or four months, latterly much more frequently. At first they lasted a day or two, recently longer. On admission she had not been free for nearly a week. It was stated that the tumour enlarged at the monthly periods.

On admission, a rounded mass of the size and shape of the adult kidney lay horizontally across the right half of the abdomen at the level of the umbilicus; this moved with respiration through a space of about 2 inches; by manipulation it could be made to slip out of reach under the ribs, but not downwards. Resonance over the tumour was comparatively high-pitched. Pain and nausea were produced by pressure upon it. There was aching in the right loin and back, and right side of the abdomen. The general look of the patient was that of health. The legs were slightly œdematous. The urine was highly albuminous, and contained granular casts and pus-cells. The symptoms quieted with rest, and the patient left the hospital free from pain.

She was re-admitted under my care on February 13, 1878. The pain in the tumour and in the loins had returned a fortnight after her dismissal and been constant since, in addition to which she had severe paroxysms of pain, attended with vomiting, once every two or three weeks. The urine was said to have contained blood, but none was found and only a trace of albumen. The tumour was as before. With rest in bed, pain and vomiting ceased, and she left the hospital much relieved before any further measures were adopted.

Movable right kidney in a man probably the result of violence.

A gentleman of about twenty-two years of age, of spare and active figure, who was devoted to hunting, and had had many severe falls, in one of which he had broken his leg, though so far as he knew he had never sustained any internal injury, applied to me in the following circumstances. Some months previously he had had what was thought to be an attack of cystitis with pain in the bladder and penis, and, as was stated, pus in the urine, which addition ceased to present itself a fortnight later. His object in consulting me was to know whether the urine was now natural and whether he might still hunt. The urine was alkaline and loaded with amorphous phosphates, in other respects natural. He looked in perfect health, but had slight dull pain in the right renal region, which was not increased by exertion, by shaking or by stooping, was not accompanied by tenderness, and did not pass into the thigh or testicle. He drew attention to a movable, painless lump, which he had found in the right hypochondrium, just under the liver. I could here feel a tumour in size and shape like one end of the kidney, which descended to a level midway between that of the umbilicus and the margin of the thorax, and under pressure quickly withdrew to underneath the ribs. This lay deep in the cavity of the abdomen, but did not give the impression of being so far back as the normal position of the kidney. The mass was neither tender nor painful, and beyond the slight pain in the back, which was not certainly renal, there were no symptoms. My advice was not indeed sought with regard to the movable kidney, which was only incidentally mentioned. I advised him to forbear violent exercise, whether on horseback or otherwise, but had little expectation that the counsel would be followed.

Movable right kidney in a man; cause unknown.

Mr. J. S., a gentleman of the age of fifty-seven, consulted me in the summer of 1882 for disturbances connected with a movable kidney, which had been detected five years previously by Dr. Seegen, of Carlsbad. No cause was to be traced. The patient was fairly adipose, in accordance with his time of life, and in good general health. He drew attention to a movable tumour, which could be felt deep in the abdomen on the right side, just inside the nipple line. This had the dimensions, rounded outline, and feel of the kidney. At the highest, the lower end just protruded from under the ribs; at the lowest, it was one inch below the umbilicus, four inches below the boundary of the thorax. The descent was voluntarily effected by inspiration and effort; under pressure the mass quickly ascended until all but about the lowest inch was under cover of the ribs (fig. 2, p. 1023). The line of movement was vertical. Manipulation elicited much tenderness and left soreness. There was frequent but not severe pain in the position of the movable kidney, either on bodily movement or mental excitement, and always on first rising in the morning. When his thoughts were diverted, the patient was usually unconscious of the discomfort; when he thought of it he was aware of a dull heavy sensation, as if the moving body were a four-pound weight. His chief trouble, however, was connected with the bowels, which acted loosely under mental excitement or bodily movement; the diarrhœa, for it amounted to no less, being so connected in sensation with the movable kidney as to give the patient the impression that the functional disturbance was connected with the organic mobility.

There had been no history of the passing of blood or gravel, and the urine on examination was found to be natural, save that it contained cells of flat epithelium, such as might have come from the pelvis.

The diarrhœa and pain were greatly, almost completely, controlled by recumbency and opium, and with the general good health and fair comfort of the patient, I had no hesitation in advising him to remain content with such relief rather than to seek for radical cure by excision.

Movable kidney associated with general neuralgia; question of operation.

On January 26, 1881, I was consulted by Dr. Parr, of Kensington, with regard to Mrs. S——, a lady of the age of thirty-six, the mother of four children. She was born in India, but had been in England for five years. Three years before leaving she had suffered much from pain, apparently neuralgic, which was widely distributed over the left side of the body, affecting the neck, thorax, arm and leg, and was worse at the menstrual periods. More recently, while still in India, she began to have pain in the right lumbar region, which was aggravated by movement and at the monthly times. She had some frequency of micturition, especially after exercise, but none at night, and had not to her knowledge passed blood or gravel. I found her with pain and tenderness in the right hypochondrium, and felt a lump just below the liver, deeply placed by the side of the spinal column. She was somewhat 'abdominous,' and palpation deep and difficult, but the size and situation of the mass were such that I had no hesitation in inferring it to be renal. The lady had many friends to satisfy, and sought many medical opinions. Accomplished observers expressed diverse views as to the nature of her complaint—that it was wholly neurotic, that it was hepatic, that it was renal, the supporter of the latter view resting it confidently on the ground that the tumour could be made to move like a pea in a pod, an essentially renal characteristic. When the nature of the mass had thus declared itself by its mobility, it was thought expedient to obtain a surgical and an independent view. The surgeon regarded the tumour as hepatic, but when assured of its 'renality,' professed his readiness to remove either the kidney or a stone from its interior. Upon the offer I was asked again to examine the patient. She was placed under chloroform so as to allow of a perfect examination of the tumour, which its tenderness had before prevented. It presented exactly the shape and size of the lower half of the kidney; when depressed it came into cognizance, descending to a point about half-way between the ribs and the umbilicus; under pressure it slipped up out of reach. The urine contained a trace of albumen, a few pus-cells, and many crystals of uric acid and oxalate of lime. A solitary cast was seen. As to the question of operation, this was held to be unadvisable, not only on the general ground that the movable kidney is so little dangerous that severe risk was not justifiable in its removal, but that in this case there was severe neuralgia on the other side, which the nephrotomy, should the patient survive it, was not likely to benefit. The feasibility of support by truss or bandage was set aside by the fatness of the abdomen and consequent depth of the tumour.

Movable right kidney after efforts in lifting. Relief from truss.

On November 6, 1882, I was consulted by Mrs. Y——, a lady of the age of thirty-five, who had been married for fourteen years, and had eight children. Five and a half years previously she had a 'nervous attack' after confinement, with pain in the left leg, but otherwise had good health until the beginning of her present ailment, which occurred in this wise a year and a half before I saw her. She undertook the nursing of her husband, who had become helpless from illness and had to use great efforts in lifting him; under this employment she gradually got pain through the right side, from the front to the back, immediately below the edge of the thorax. This was not severe or even very troublesome, excepting that after irregular intervals, which varied from five to ten days, she had attacks of intense pain by which she was completely prostrated for ten or twelve hours. The pain passed under the liver from the front of the abdomen to near the spine, and was accompanied with vomiting. These attacks which constituted her chief distress were relieved by rest in bed and the hypodermic injection of morphia. Before I saw the patient a bandage had been applied without avail and excision of the kidney suggested.

A rounded resistant mass of the shape and size of one end of the kidney could be felt to emerge from beneath the right edge of the thorax under inspiration and voluntary effort, and with pressure to retreat as rapidly in the direction whence it came. The tumour presented itself on the lateral aspect of the abdomen 2½ inches from the middle line; at its lowest it reached about an inch below the umbilicus; its line of movement appeared to be vertical. The positions of the tumour were almost exactly those represented in diagram 2, page 1023). Handling of the tumour gave a sensation scarcely amounting to pain. The general aspect of the patient was that of perfect health. The urine contained a trace of albumen, no blood or casts, a few pus-cells, and a quantity of epithelium; some if it was squamous as if from the vagina, and some tesselated and tailed, possibly from the pelvis.

The treatment consisted in the adaptation of a truss, of which the main spring passed half round the body, a pad at one end resting on the spine, while at the other was a conical compress in which was a spiral spring, which made deep pressure into the right hypochondrium. This proved so successful that from the time of its application the attacks of pain ceased, and she appeared to be restored to perfect health. Six months afterwards she told me that the relief given by the instrument was such that she could not possibly do without it. She had been once attacked by the old pain after much walking.

Talitha Edwards, sixty-three years of age, a widow who had had nine children, was admitted into St. George's Hospital under my care, December 15, 1880. She then had bronchitis, of which she had had many previous attacks. She had formerly had and recovered from two attacks of paraplegia. Five years before admission she fell off a table, and severely bruised the right loin and buttock; from this time she became subject to severe pains through the loin and down the thigh, which had become worse during the last two months, and of late nearly continuous, and so severe as to be called excruciating. The pain had been worse when she lay on the left side, and frequently accompanied with vomiting. When in the hospital she complained of continuous pain through the right hypochondrium from the front to the back, and of occasional pain in the right iliac region, in the sciatic notch, and down the thigh. The abdomen was full and fat but flabby, so that it offered no insuperable difficulty to palpation. The hand could be deeply pressed under the ribs, to the exclusion of hepatic enlargement. When she lay on the left side an oval, rounded mass, of the size of the kidney and much its shape, except that no hilum could be felt, came out from under the right ribs, and presented itself between the umbilicus and the anterior superior spine of the ilium (fig. 3, p. 1023). By manipulation, which caused much pain and made her feel sick, this could be made to withdraw itself whence it came with a sudden slipping movement. It moved similarly as she changed her position, coming out of cover when she turned on the left side. The urine was natural, excepting that it was alkaline, and contained a few pus-cells and some flat epithelium, probably from the vagina. The treatment on this occasion consisted mainly of rest and opiates, of which the hypodermic injection of morphia was found to give most relief. But severe attacks of pain continued to recur, and the patient left the hospital much as she entered it.

On April 16, 1883, I procured her return, as I wished to give her the benefit of a truss of a kind I had recently employed. She still had much pain of the kind previously described, in addition to which she had recently had severe shooting pains in the left side of the epigastrium, where a pulsation like that of one of the branches of the aorta could be detected, but no definite tumour. Her pain had been such that she had been long unable to follow her pursuit, which was that of a dressmaker; her manner was nervous and her countenance worn, haggard, and expressive of long suffering. The abdomen was bulky and the movable tumour deeper than usual—somewhat unpromising circumstances for mechanical treatment; a truss, however, was provided similar to that described in reference to Mrs. Y——, with an elongated conical pad pressing into the right hypochondrium. The effect of this was striking; not only was the pain in the right side relieved, but also that on the left, so that the patient no longer needed to remain in bed, but was able to walk about in comfort, with very little vestige of her former distress.

Movable kidney after labour. Symptoms relieved by abdominal belt.

Minnie Holloway, a married woman, thirty years of age, was delivered of her fifth child on December 4, 1882, after a tedious labour in which, according to her statement, she was unattended. Her recovery was not different from her former experiences until, after three weeks, she began to get about. She then was attacked with severe pain, which passed from the spine at the renal level round the right hypochondrium just below the ribs, and downwards across the right umbilical region to the groin, where it terminated about the middle of Poupart's ligament. This compelled her to keep her bed for a fortnight, during which time the pain was severe, continuous, accompanied with nausea, as often as once a day with vomiting, and with frequent shivering. At the end of the fortnight the pain so much abated that she was nearly free from it while at rest, though movement never failed to bring on a recurrence of it. The symptoms were supposed to be due to uterine inflammation, and on March 28, 1883, she obtained admission at St. George's Hospital under Dr. Barnes. He could discover no evidence of uterine disease, but found a movable tumour in the right hypochondrium, which he considered to be a movable kidney, and in this belief transferred the patient to me on the 30th.

She was not thin, and save that she was somewhat flabby had the general appearance of health. She complained of an aching pain in the right axillary line just below the edge of the thorax, in which position a rounded oval tumour could be felt, which had the dimensions of the kidney, and with very slight pressure slipped upwards and was lost under the ribs. With inspiration it again presented itself, and when breath was drawn deeply could be felt as low as, and even at times lower than, the umbilicus. It ranged, as represented in the diagram, from the thoracic edge to about the level of the spine of the ilium, and from the lateral limit to about midway between this and the middle line (fig. 5, p. 1024). Pressure on the mass caused but slight uneasiness, manipulation was well borne, and indeed it was chiefly by this means that the limits of movement were made out to be as wide as represented. The right lumbar hollow was deeper and more resonant than the left. The urine was natural, excepting that it contained epithelium, evidently of vaginal origin.

A truss, such as was used in the case of Mrs. Y——, was adapted and gave relief to the pain, but she complained that the pressure made the region of the tumour tender. An elastic support was then made such as is commonly known as a riding-belt, with the addition of a firm circular pad which compressed the right hypochondriac region. This was successful in all respects; with it the patient was able to walk about without discomfort, and left the hospital perfectly relieved of the symptoms for which she had entered it.

Movable right kidney after labour. Relief from bandage and pad.

Charlotte Roberts, aged thirty-eight, a married woman, working as a dressmaker, the mother of two children, was admitted under my care in St. George's Hospital on April 16, 1883. She had had good health until the birth of her second child thirteen years before, immediately after which she observed for the first time a lump in her right side which will be presently described. She thought this had been caused by some injury inflicted during the forcible removal of the after-birth. Eighteen months afterwards she had 'inflammation of the womb,' for which she had leeches applied internally.

When admitted she was somewhat anæmic, and complained of weakness and nervousness, symptoms which she associated with the lump in her side. The abdomen was somewhat thin, and it was easy to feel a mass which corresponded in shape and size with the kidney, which emerged from the right hypochondrium, and descended so far that its lower end was within half an inch of the level of the spine of the ilium. With gentle pressure the mass slipped up out of reach under the right ribs (fig. 4, p. 1023). Pressure on the movable organ caused a dull pain with a feeling of sickness, sometimes pain of a more acute kind. Irrespective of pressure, the patient had at times pain diffused over the right lumbar region and under the lower part of the sternum. She was liable also to attacks of vomiting, which recurred at intervals varying from a week to a fortnight, which were accompanied with pain and the passage of much clear urine.

The upper abdominal region was experimentally encircled with ordinary elastic webbing, under which at the point of emergence of the tumour was a thick firm pad. This was found to give so much relief that an elastic belt was made to fit her, with a pad as in the case last reported. This appeared to give complete relief, and she left the hospital in comfort.

Movable right kidney after labour. Intercurrent albuminuria. Use of truss.

On March 31, 1883, I saw with Dr. Fergusson, of Richmond, a lady in whom he had detected a movable kidney. She was thirty-eight years of age, the mother of seven children. Six years previously, on recovering from chloroform which had been administered during her fourth labour, she became aware of severe pain which passed round the right side of the body from the spine to the anterior median line, parallel to and immediately beneath the lower boundary of the thorax. This was so severe as to keep her awake for the greater part of three or four nights. There was no vomiting nor any recognised urinary trouble. Afterwards the pain gradually abated, but did not entirely leave her for long together. It became for a time worse after each subsequent confinement, at the monthly periods, and after exercise or movement as in travelling. With rest it always got better, and often almost ceased for a time. It never extended into the leg or groin. There was never any vomiting, nor did there occur any such exacerbation with constitutional disturbances as are sometimes found in connection with the movable kidney. The point which chiefly excited apprehension was the occasional appearance of albumen in the urine, sometimes a mere trace, sometimes as much as a fifth, which presented itself usually about mid-day, after she had moved about, the urine passed on rising being natural. It appeared that about a year before, the patient had for a time passed bloody and albuminous urine after taking cold, and it was presumed that the intermitting albuminuria now observed was the residuum of this attack.

The patient was pale, flabby, by no means thin, with a soft loose abdomen. As she lay on her back a tumour of the size and shape of the kidney could be felt to emerge under inspiration from under the right ribs, and present itself almost at any spot on the right anterior region of the abdomen, even so low down as the iliac fossa. It gave the sensation of being very loosely tethered, so that a little pressure with the hand made it move laterally or downwards, or suddenly to slip up out of reach with characteristic alacrity. The extent of movement is represented in the diagram (fig. 6, p. 1024). Five inches were measured vertically from the point of disappearance at the edge of the ribs to the upper end of the mass when at its lowest; thus any given point of the movable organ must have ranged through at least eight inches. Laterally the movement was about four inches. Pressure caused slight discomfort, but nothing that was much complained of. The pain, which passed round the right hypochondrium, extended, though less severely, into the left, and the patient had the belief that the left kidney was movable as well as the right. I could not, however, find any tactile evidence of this.

There was no evidence of renal disease apart from the albuminuria and the mobility of the kidney, no œdema, nor any sign of cardiac hypertrophy or of vascular tension. The urine was of natural appearance and good specific gravity. I examined specimens passed both by day and by night, and found in both a trace of albumen scarcely enough to precipitate. There were no casts or morbid products which could be distinctly recognised as renal, but much vaginal epithelium. I thought that the trace of albumen was the result of the attack of nephritis and not connected with the mobility of the kidney. Iron was given in view of her general state, and to keep the organ in place a truss was constructed, identical with that used by Mrs. Y——. This was quite successful in keeping the kidney in place and relieving the lumbar pain, but the patient complained somewhat of its pressure, and I suggested the trial in its place of a pad and elastic bandage.

CHAPTER XVI.

URINARY PARAPLEGIA.

Certain renal diseases are liable to produce paraplegia. Malignant growths beginning in the kidney may encroach upon the vertebræ and eat into the spinal canal with results as strongly pronounced in the way of paralysis as are found to follow fracture or dislocation (see p. 779). Whether pus, which has broken out of the kidney ever penetrates the inter-vertebral foramina I do not know; it seems not impossible, but I have not yet found an instance.

Origin of the theory of reflex paralysis.

Advancing still further into the region of hypothesis we come to the doctrine of Reflex Urinary Paraplegia, which was conceived by Stanley, christened by Graves, and adopted by Brown-Séquard. The theory of Stanley was that an irritation commencing in the kidney was conveyed by the nerves to the cord, which itself underwent no change but transmitted the irritation to the lower limbs, to the impairment of their nervous function. The theory later took more definite shape, and met with much, and for a time with general, acceptance. The mode of operation was thought to be clearly made out by reasoning and experiment, and under the great authority of Brown-Séquard became a part of medical belief. Anæmia of the cord was believed to be the essential change, this being brought about by a spasm of its blood-vessels, and this by an irritation carried to their nerves from the part, whether kidney or bladder, which was primarily at fault. If a nervous centre, it was urged, be deprived of blood, its function is abrogated, as hemiplegia may result from the tying of a carotid, or paraplegia from ligature or compression of the aorta. So the cord, if deprived of blood, though only by vascular spasm, may feasibly be supposed to cease to act as a channel of nervous influence. This theory is so generally accepted, at the same time that its application to the kidney and the existence of urinary paraplegia as of reflex origin have been so gravely questioned, that it is necessary to look somewhat narrowly at the facts which bear upon this part of the question. Dr., now Sir W. Gull, in a judiciously sceptical paper[1] showed that in some of the cases which had been accepted as of reflex paraplegia the paralysis was not real, while in others it was not reflex but more probably connected with organic disease of the cord, and later still Dr. Weir Mitchell in a no less masterly criticism[2] not only enforced the incredulity which since Gull's paper had begun to attach itself to the interpretation which Stanley and Graves had put upon their cases, but also threw doubts upon the whole theory of reflex paralysis. It was urged that it was highly improbable that a vasal spasm could be steadily maintained for months or years without any intervals of relaxation; while supposing it to be so maintained with completeness enough to abolish function by want of blood it was inconceivable that a tissue so mobile as the nervous should not become softened or show otherwise in textural change some result of the prolonged starvation to which it had been subjected. Softening of the brain rapidly follows embolic obstruction, and no less so when the blood has been cut off by ligature, as of the carotid, presuming that the collateral circulation is not efficient for vicarious duty.

The questions to be answered are two—first, whether there is any such thing as *urinary paraplegia*; whether in any way, by nerves or vessels, by any reflexion, conveyance, or extension of disease apart from the encroachment of a growth, paraplegia is brought about as a consequence of disease of the urinary organs;—and secondly, whether if paraplegia does arise from this cause, whether it comes on without material change in the cord by the mere suspension of function which is implied by the term reflex. To find replies I will briefly review some of the evidence which has been adduced.

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[1] 'On paralysis of the lower extremities consequent upon disease of the bladder and kidneys,' by W. Gull, M.D., *Guy's Hospital Reports*, 1861, vol. vii. p. 313.

[2] 'Paralysis from peripheral irritation,' by S. Weir Mitchell, M.D., *New York Med. Journ.* 1866, vol. ii. p. 321.

Views of Stanley.

Mr. Stanley in the paper wherein the theory of urinary paralysis was first propounded, related seven cases as examples.[1] In five of these the supposed cause of the paraplegia was that disseminated suppuration of the kidney which, as we now know, is so consistently a result of it. Disease of the cord, paralysis of the bladder, putrefaction of urine, and scattered renal suppuration as the result of absorption, is a morbid sequence which is well made out and presents itself but too often. It is at least a suspicious circumstance that the particular form of renal disease which is credited with having produced spinal paralysis is precisely that which spinal paralysis so regularly produces.

Equivocal nature of his cases.

It is to be presumed, in the absence of any conclusive evidence to the contrary, that what Stanley supposed to be the cause was in reality the effect, and his deduction, so far as it is based on cases of this nature, correspondingly mistaken. That it was so must be clear to anyone who reads the cases. Four of these present much the same outlines: a man perhaps has an injury to the spine or he has pain there, or without either he becomes unable to move his legs or pass his water. He dies with the kidney of disseminate suppuration, but with no disease of the spinal cord which is evident to the naked eye. Presuming one of the many changes to exist in the cord which are effective for its destruction though not for its disfigurement, the sequence becomes intelligible and consistent with our daily experience. With the naked eye only almost any change confined to the cord short of diffluence might escape notice. It is therefore impossible to infer that the cords in these cases were healthy or the paralytic symptoms and the renal lesion otherwise than dependent upon spinal disease. The argument as applied to these of Stanley's cases is equally suited to a large number of similar ones related by other authors, and it may be stated as a general conclusion that when the kidney of scattered suppuration is concurrent with paraplegia the disease of the kidney is not the cause but the consequence.

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[1] 'On irritation of the spinal cord and its nerves in connection with disease of the kidneys,' by E. Stanley, *Med.-Chir. Trans.* 1833, vol. xviii. p. 260.

Among the other conditions regarded by Stanley as the cause of paraplegia without disease of the cord is dilatation of the kidney. This was exemplified by a case supplied by Burrows of a man who for two years had had severe pain in the spine and incontinence of urine whose kidneys were found after death with dilated and inflamed pelves and mottled structure. The spinal cord displayed no further evidence of disease than much vascularity of the lumbar pia mater and an excess of fluid within the sheath. During life there had been much tenderness about the sixth dorsal vertebra, difficulty of breathing, and the involuntary passage of urine and fæces. Presuming the vascularity and excess of fluid to indicate disease of the cord, as we cannot doubt that they did, notwithstanding that in the absence of microscopic examination no other evidence of disease was discovered, the whole case is clear. The condition of kidneys is precisely that which must necessarily result from long continued paralysis of the bladder with retention of urine, and it needs no further argument to justify the obvious conclusion that the renal disorder was the result not the cause of the spinal.

Two cases are related in which complete motor paralysis, involving the lower extremities and the sphincter together with loss of sensation ensued upon gonorrhœa; one was fatal in sixteen hours, the other in about a fortnight, with sloughing. In the more rapid case the kidneys were found to be merely congested, in the other they contained abscesses. In the more rapid case the cord was congested, in the other it appeared natural. It is scarcely possible to doubt that in both these cases myelitis was present though not disclosed to the naked eye. The completeness of the paralysis and the sloughing are characteristic of disease of the cord of definite and acute kind, while we have the light of several cases minutely examined by Sir W. Gull in which paraplegia ensuant as in these instances upon gonorrhœa was found to depend upon distinct inflammatory change in the cord, appreciable with the microscope, and in one instance not otherwise.[1] Sir W. Gull infers that paraplegia after gonorrhœa is produced by means of an infection, whether purulent or specific, which is conveyed to the cord after the manner in which the swelling of the joints and the other secondary results of gonorrhœa are produced: and I think we need not hesitate to accept this conclusion.[2]

Thus it may be argued that of Stanley's cases from which the theory of urinary paraplegia was originally constructed there is not one which, according to our present knowledge, is to be explained on that principle. It is to be presumed that in every one there was disease of the cord, either as a primary lesion or as the consequence of gonorrhœa, to which as constantly the renal changes were secondary.[3]

Graves and d'Etiolles.

Many other instances of supposed reflex paraplegia following upon gonorrhœa, some of which have ended fatally and some in recovery, are scattered through medical literature, but in the absence of minute examination of the cord it may at least be said that none are conclusive. Dr. Graves's cases, published soon after Stanley's, are equally equivocal with his; some, indeed, more so, if that is possible:[4] in one a tumour, the size of 'half a very small hazel nut,' was found external to the sheath of the cord, and it is not unreasonable to suppose that this may have had some share in producing the paralysis which existed of the legs and bladder.

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[1] 'Cases of paraplegia associated with gonorrhœa and stricture of the urethra,' by W. Gull, M.D., *Med.-Chir. Trans.* 1856, vol. xxxix. p. 195.

[2] *Med.-Chir. Trans.* vol. xxxix. p. 199.

[3] See case quoted by Rayer, *loc. cit.* vol. iii. p. 174, also by Graves. *Clin. Lectures*, vol. i. p. 554.

[4] Graves, *Clin. Lectures*, 2nd edition, vol. i. p. 563.

M. Leroy d'Etiolles has published a large number of cases of supposed urinary and reflex paraplegia, many of which were of gonorrhœal origin, and may probably be explained by implication of the cord in the manner already suggested. Others are cases in which the weakness of the legs, as justly remarked by Sir W. Gull, appears to be not more definite than as part of general debility,[1] which the lower extremities, as having to support the weight of the body, usually express more distinctly than the upper. This is notably suggested in the instance of a man who died with an abscess in the neighbourhood of the bladder, consequent upon urethritis, together with disseminated renal suppuration. He had a trembling gait, and dulness of sensation, which appeared to be general. He had diarrhœa, and soon sank into the state of prostration which characterises purulent absorption.

Similar remarks will apply to a man with stricture and perineal abscess, who had weakness of the legs with some obtuseness of sensation, coincidently with a febrile attack which caused much prostration.

Of the cases related by this author those in which the reflex theory is best borne out are some in which enlargement of the prostate, or stricture of the urethra independently of gonorrhœa, were followed by loss of power in the lower limbs, which in some instances was restored after the discharge of an abscess, the use of the catheter, or some other surgical procedure. The paraplegia seems, as a rule, not to have gone beyond enfeeblement of the limbs, though the circumstance that this was in some cases more marked in one leg than the other is a point in favour of its being more than mere weakness. In one case spasmodic and convulsive movements (of the lower extremities?) occurred at the time of emission of urine. In this instance some loss of sensation was noted in the lower limbs, while the motor power in the two was unequally impaired. The patient recovered after the evacuation of a prostatic abscess.

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[1] Case of Potemain, pour le Docteur R. Leroy d'Etiolles, *Traité des Paraplegies*, p. 33.

Paralysis sometimes due to septic absorption,

It is scarcely to be doubted that in this and in a few similar instances there was some degree of real paraplegia, as a result of disease of the bladder or prostate, and therefore properly to be called urinary; but to call it reflex, or in other words to assert it to be independent of disease of the cord, is to go not only beyond evidence but beyond probability. It is to be observed, as pointed out by Sir W. Gull,[1] that where paraplegia has ensued there has always been suppurative inflammation, mostly as a circumscribed abscess in or about the urinary organs, and the inference is obvious that by the veins or otherwise there has been some extension of the inflammatory process to the cord. Myelitis after gonorrhœa is a sequence which may be considered as beyond doubt; and it is at least probable that a similar result may now and then ensue after other kinds of suppurative disease. It is to be observed that with many of these cases there have been rigors or other febrile symptoms consistent with purulent absorption. A case directly to the point is quoted by Sir W. Gull.[2] A man, long the subject of stricture, with retention of urine, underwent, together with other measures, daily dilatation of the urethra; in the course of them he became feverish and rather suddenly paraplegic. A slough formed on the sacrum, the evacuations passed involuntarily, and he died one month after the outset of the spinal symptoms. 'A small quantity of pus was found lying on the outside of the sheath of the cord, opposite the bodies of the sixth, seventh, eighth, and ninth dorsal vertebræ, and one of the vertebral veins in the lumbar region was full of well-formed pus. The spinal fluid was densely coagulable. The arachnoid was thickened, and presented traces of recent inflammatory exudation. The dorsal portion of the cord was very distinctly and generally softened. An old stricture existed at the commencement of the membranous portion of the urethra, and several false passages, one opening into an abscess behind the bladder, and two returning into the bladder. The vesical veins in the neighbourhood of the pelvic abscess were thickened and partially obstructed by recent lymph.' In this instance the process is made clear; and it is not to be doubted that in others paraplegia has similarly been brought about by the conveyance by the veins of purulent or septic matter from the urinary to the spinal region. The veins inside the spinal canal communicate freely with those outside the vertebræ, and these with the vessels ascending from the pelvis and lower extremities. The veins of the vertebræ have no valves, so it is conceivable that blood may occasionally flow from without inwards, even though the current be commonly in the reverse direction.

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[1] *Guy's Hospital Reports*, vol. vii. p. 328.

[2] 'Cases of paraplegia associated with gonorrhœa and stricture of the urethra, *Med.-Chir. Trans.* 1856, vol. xxxix. p. 198.

Apart from the cases where inflammatory or septic products may be supposed thus to have impinged upon the cord we find nothing to encourage a belief in urinary paraplegia. It does not arise from stone, great as is the nervous irritation shown in other modes which stone, especially in the kidney, produces.

sometimes to causes unconnected with urinary disease.

Other observers, mostly coeval, or but shortly after those I have referred to, have published cases which at the time were explained on the reflex theory, but which now present themselves with sufficient clearness in another light. Mr. Spencer Wells published a lecture[1] on 'Incomplete Paralysis of the Lower Extremities connected with Disease of the Urinary Organs,' but the condition he describes, as he himself would now readily admit, is one in which the bladder has simply participated in a more or less general loss of nervous power. There is no stricture or definite urinary disease, but merely a loss of expulsive power, together with other signs of muscular failure. The description applies, indeed, with much accuracy to locomotor ataxy. This transposition of cause and effect is apparently not of uncommon occurrence in the annals of reflex paralysis. Loss of power in the bladder and retention without stricture may possibly be the first noticeable signs of structural disease of the cord; cystitis probably will quickly follow, and it may not be until afterwards, particularly if the patient be in bed, that the paralysis becomes evident in the lower extremities; this therefore may present itself as secondary in time, and ostensibly in cause, to the urinary disturbance.

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[1] *Med. Times and Gazette*, November 14, 1857.

Recent observation has added nothing to the records of reflex paraplegia of urinary origin. I have long sought but hitherto failed to recognise the condition, and I find that other inquirers have met with the same want of success.[1]

It is to be fairly concluded from the evidence which has been brought forward that—

Conclusion.

Paraplegia may as a rare occurrence ensue upon certain inflammatory disorders of the bladder and neighbouring parts, more especially when these are of gonorrhœal origin; it is then a result of the extension to the cord of an inflammatory condition by infection or otherwise, presents the symptoms of myelitis, and may be fatal, even rapidly so, a circumstance inconsistent with the supposed character of reflex paralysis.

We have no evidence that disease of the kidney extends to the spine by similar means. When the suppurating or 'surgical' kidney concurs with paraplegia, the renal condition is not the cause but the consequence of the paralysis; the same may be said with regard to renal dilatation and pyelitis.

There is no evidence of, but, on the contrary, many reasons to doubt, the existence of a form of paraplegia dependent on the state of the urinary organs but independent of structural change in the spinal cord. In many instances supposed to be of this nature the evidence of paralysis is defective, in others there is reason to believe that the nervous disorder has actually preceded the urinary, though the urinary symptoms attracted notice as the first sign of spinal failure, while in no instance of paraplegia associated with urinary disease has the cord been asserted to be healthy save on examination which has been entirely insufficient and inconclusive.

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[1] Dr. Wilks, *Diseases of the Nervous System*, p. 231.

Thus, though it is to be admitted that within certain limits paraplegia may be urinary, there is no evidence to show that in any circumstances it is reflex.

CHAPTER XVII.

DISEASES OF THE URETERS AND LARGE BLOOD-VESSELS.

Diseases of the Ureters.

Importance of disease of ureter.

As of all tubes, diseases of the ureter tend to its obstruction, which whether complete and of both sides and rapidly fatal by suppression, or incomplete or one-sided so as to give rise to hydronephrosis, is of so great importance as a source of disease that it would be difficult to find any other part of the body where so small an extent of lesion is productive of such formidable results. The ureters have little liability to independent disease, though they may be congenitally defective in various ways, may be involved in surgical accidents, and are apt to be damaged by morbid products and share in morbid processes which take their rise elsewhere.

Congenital imperfections.

An ureter appears sometimes to have been impervious from birth and shrunk to a cord, while the corresponding kidney has become atrophied, usually with cystiform dilatation of the pelvis, while the other has been hypertrophied.

There is a preparation at St. George's Hospital showing a congenital obstruction by means of a valvular fold of mucous membrane in the portion of the duct which passes through the wall of the bladder. The ureter behind this was dilated to the thickness of the colon and the kidney in a state of cystic degeneration.

Sometimes the development of the kidney and its duct appears to have been arrested simultaneously, as in an instance under my own observation in which a shrivelled kidney, weighing but 43 grains, was connected with a ureter which though partially pervious was much shrunk and terminated in filaments before reaching the bladder. In this instance, as in many such, there were no symptoms, but the importance of the condition is obvious as half-way towards suppression.[1]

A similar result[2] has been described as due to malposition, the duct starting, not at the bottom of the infundibulum, but at its side, so as to be liable to obstruction from lateral pressure; but I must refer to the chapter on Hydronephrosis for reason to believe that many such malpositions and valvular arrangements are the consequences of obstruction and dilatation, not their cause. Supernumerary renal arteries compressing the upper part of the ureter have in the same place found sufficient mention.

Results of violence.

The ureters are little exposed to violence from without and seldom suffer except by such injuries[3] as are likely to produce fatal or at least obvious results. Constrictions of the ureter have been attributed to this cause sometimes on inconclusive evidence. An instance is elsewhere referred to where stricture of the ureter,[4] and consequent pyonephrosis were traced to a kick from a horse. After rupture of the kidney by external violence the pelvis has been known to become filled with coagulum, and the ureter thus completely and permanently stopped. A kick from a horse on the right hypochondrium was followed by collapse and hæmaturia; the hæmaturia did not occur after the second day, and the patient recovered, to die eighteen months later with granular kidneys. It was then found that the kidney had been ruptured into the pelvis,[5] which, together with the upper part of the ureter, had become filled with coagulum, to the complete and permanent obstruction of the duct.

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[1] St. George's Hospital Museum. Series xi. p. 7.

[2] Julius Pollock, *Path. Trans.* vol. xvi. p. 181.

[3] *Path. Trans.* vol. x. p. 209.

[4] Pye Smith, *Path. Trans.* vol. xxiii. p. 159.

[5] St. George's Hospital Museum. Series xi. p. 4, *Path. Trans.* vol. xi. p. 140.

Inflammation

Inflammation of the ureter is usually a result of the ascent of cystitis or of the descent of stone. In the former relation it has been sufficiently referred to in connection with pyelitis as the result of gout or gonorrhœa. Under inflammation the mucous membrane of one or both ureters, in part or wholly, may become swollen, congested to a purple colour, and bathed with pus. A man in St. George's Hospital had continued shooting pains in the lumbar region, pain in the abdomen, pus in the urine, and frequency of micturition, which symptoms were succeeded by uncontrollable vomiting, prostration, and death. He had been sounded for stone but none found, nor was any discoverable after death. Both ureters were in the state referred to from near the bladder to within about three inches of each kidney. The bladder and pelves were slightly vascular and contained small quantities of pus. No other lesion was found save slight recent endocarditis. The kidneys themselves were healthy. There was no history of gonorrhœa, but whether set up by this cause or by calculi which had escaped, it appeared that the inflammation of the ureters was much concerned in the production of the symptoms.[1] The ureter has been known to become lined with lymph under the inflammatory process, or, as in an instance recorded by Murchison,[2] to be coated, in common with the calyx of its kidney, with a loosely adherent membrane, resembling that of diphtheria, shreds of which were passed with the urine during life. The kidney itself was studded with small abscesses. In this instance as in the last the inflammation was attributed to the passage of stone, but none found. The ureter has been known to become surrounded from the bladder to the kidney with suppurative inflammation of the cellular tissue which involved also the renal and vesical neighbourhood; in the case I refer to some small

may result in false membrane within,

or suppuration around.

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[1] *Path. Trans.* vol. xix. p. 281.

[2] *Ibid.* vol. x. p. 191.

calculi were found in the peritoneal cavity and the affection ascribed to perforation by them, though its position was not discoverable at the time of the post-mortem examination. The local suppuration was succeeded by pyæmia.

Stricture;

Injury, probably ulceration, caused by stone may be succeeded by stricture, or even complete occlusion, and thus give rise to dilatation and atrophy of the kidney, possibly with pyelitis or hydronephrosis or taking a half share in suppression of urine. When not causing complete obstruction the irritation of stone at the top of the ureter will sometimes cause this part of it to become thickened and imbedded in fat.

tubercle and cancer.

It is not necessary to add to what has found place elsewhere with regard to tubercular disease of the ureter: thickening and ulceration of its wall often with total and permanent obstruction of the channel is an accompaniment, usually a result, of tubercular disease of the kidney. Malignant growths are less common, as proper to the ureter, than tubercular, though this duct is often encroached upon by cancer from without. Cancer confined to the ureter is, I believe, unknown, though it often participates in renal and vesical growths. Its walls from end to end[1] have become thickly infiltrated with malignant matter continuously with a like formation in the bladder, and superficial patches of fungous growth have been found upon its mucous surface in connection with a renal growth as if descending germs had taken root.[2]

The wall[3] of the ureter has been known to become infiltrated in connection with the development of lymphadenoma elsewhere.

Cancer of the bladder may encroach upon and stop the channel of the ureter as it passes through the vesical wall, and the same result may be produced by polypoid

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[1] *Path. Trans.* vol. xviii. p. 158, case by Dr. Bastian.

[2] *Ibid.* vol. i. p. 155, case by Mr. Simon.

[3] Dr. Coupland, *Path. Trans.* vol. xxviii. p. 126.

Effects of disease external to ureter.

and other growths. I knew a case in which a small mucous polypus grew from the bladder in such a position as exactly to close the orifice of this duct and cause dilatation of it and of the kidney. Growths external to the urinary organs often involve the ureter; some such have been referred to in connection with suppression of urine: tumours, especially when malignant, of the uterus, vagina, or ovary, may thus invade and close one or both ureters; an instance is related by Dr. Burdon Sanderson[1] of a fibro-cellular tumour which had sprung from the capsule or hilum of the kidney and embedded the ureter in its mass, constricting the duct at its origin to the size of a crow-quill. Beside growths of various kinds the ureter has been compressed by fibrous bands, the result of inflammation of the uterus or in its neighbourhood, or variously constricted in consequence of displacement of that organ.

Dilatation.

It is not necessary to remark further upon dilatation of the ureters, except that both may be dilated, together with the pelves, in consequence of chronic difficulty in emptying the bladder, and that with such stretching the valvular passage through the vesical wall necessarily becomes ineffective, so that the contents of the upper channels become contaminated by those of the lower, with results which are explained with the subject of renal suppuration. In connection with, and probably as a result of their dilatation from urethral obstruction, the ureters have been known to become prolapsed into the bladder by reason apparently of the downward pressure exerted by the swollen and rigid cylinders into which the flaccid and yielding tubes have become converted.[2]

Prolapse.

Dilatation.

The ureter has been known to become dilated to such an extent as to cause an abdominal tumour more or less resembling that of hydronephrosis. An instance is mentioned at p. 828 in connection with that subject; another was reported by Mr. Estlin[1] and is referred to by Dr. Bright. A man had a tumour 'of an oblong form, situated in the right hypochondrium, about the edge of the rectus muscle, extending nearly from the eleventh rib to the right side of the symphysis pubes, and being particularly prominent about the situation of the internal abdominal ring. It somewhat distended the integuments, so as to be perceptible to the eye, and might be considered to be about three inches in width.' The swelling repeatedly subsided on the emptying of the bladder with a catheter. After the patient's death, which occurred under an attack of influenza, it was found that the tumour was the right ureter enormously dilated and thickened. The prostate gland was the seat of three semi-cartilaginous tumours, by which the orifice of the urethra was obstructed. The bladder was sacculated and contained a large number of phosphatic calculi which varied in size from that of a chestnut to that of a pea. It is not explained why one ureter was dilated and not the other: possibly a calculus may have determined the inequality.

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[1] *Path. Trans.* vol. xiv. p. 195.

[2] T. Smith, *Path. Trans.* vol. xiv. p. 185.

Perforation by abscess.

The ureter may be perforated by abscesses of neighbouring parts and the pus thus find exit with the urine. An ordinary psoas abscess may do this, as is testified by a preparation at King's College, as also may a pelvic abscess of puerperal origin. A patient of the late Dr. Lee in St. George's Hospital discharged pus with the urine for three years after pelvic cellulitis of this nature. An abscess then opened upon the back, and death shortly followed. An irregular suppurating cavity was found below the left kidney, which opened upon the loin and also into the ureter which, at about its centre, was lost in the abscess. The kidney was dilated and atrophied. This case bears also upon the subject of perinephritic abscess after labour. A fæcal abscess was supposed by Dr. Ord to have entered the ureter: it had certainly entered some part of the urinary tract, as fæcal matter was found in the urine; but the case does not rest on post-mortem evidence.[1]

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[1] The details are to be found in the *London Medical Gazette*, vol. ii. 1828, and vol. xx. 1837, references which we owe to Mr. Morris.

DISEASES OF THE RENAL ARTERY.

Congenital defects.

The renal artery is liable to certain anatomical peculiarities and defects of development which it is not my purpose to refer to except so far as they are associated with renal disease or deficiency. The supposed origin of hydronephrosis in compression of the ureter by a supernumerary vessel has been already mentioned.

In many cases of congenital atrophy of one kidney the artery has been found to be incomplete or impervious, notwithstanding that the duct and vein have been open, as if the defect in the artery was the cause of the general defect of development or nutrition. The shrivelled and effete[2] remnant of the organ has generally been found to consist mainly of fibrous tissue and even in some cases to present the granular exterior and cystic change of acquired fibrosis; not, it is to be presumed, that there has been any morbid formation of the tissue which thus appears in relative excess, but rather because the lack of nutrition has told with greater effect upon the mere vascular and mobile structures than on that which is more passive and enduring.

It has frequently been noticed that where one kidney has been thus destroyed the other has become the subject of inflammatory disease, due no doubt to the increased work thrown upon the sole organ.

Obstructions by coagulum,

Embolism and thrombosis have been considered elsewhere. An interesting case is related by Dr. Moxon,[3] in which a short embolic clot from a diseased heart had stopped up the renal artery close to its origin but not extended into the organ; the aortic end of the plug was covered with a smooth membrane, and we are led to infer that the affected artery was completely closed, though from the state of the kidney it is evident that its blood-supply was not totally cut off. The chief interest is in the contrasted state of the two kidneys. The right, which remained in free connection with the circulation, was the large white kidney of Bright; a result, probably, of the disease of the heart, which was much dilated, and of which the valves were thickened as the result of rheumatism. The kidney from which the blood had been cut off was practically natural, excepting that it was of rather small size. Dr. Moxon observes upon the infrequency of unilateral Bright's disease, and suggests with probability that the smaller healthy organ had been saved by the accident which had deprived it of a large portion of its blood.

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[1] *British Med. Journ.* September 7, 1878, p. 348.

[2] See cases reported in the *Path. Trans.* by Mr. Sydney Jones, vol. viii. p. 279; by Dr. Conway Evans, vol. xvii. p. 173; by Mr. Pick, vol. xix. p. 281.

[3] *Path. Trans.* vol xix. p. 267.

by atheroma,

The renal artery becomes the subject of atheroma, though perhaps scarcely so often as some other parts of the arterial system. The atheroma has been such that the vessel has been nearly but not quite closed, with the result of fibrotic atrophy in the connected organ, which was found to weigh in a case of this sort recorded by Dr. Greenfield only an ounce and a half; or the closure has been made complete by coagulum, with resultant changes of a more acute kind, comprising chiefly anæmia of tissue, fatty degeneration, and the accumulation of leucocytes in and about the vessels.[1]

by external pressure.

The effect of complete closure of the renal artery is to stop the secretion of urine, with complete suppression should both kidneys be simultaneously affected. This point is further touched upon in connection with the subject of suppression; but I may here refer to a case in which both renal arteries were so compressed by an aneurism of the superior mesenteric that their aortic openings were reduced to mere slits. The patient had repeated convulsions, which were succeeded by coma and death. The urine was incompletely suppressed; a little which was obtained with a catheter was highly albuminous.[1]

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[1] 'Atheroma of the Renal Artery, leading to Occlusion of the Vessel and Degenerative Changes in the Kidney.'—Dr. Greenfield. *Path. Trans.* vol. xxvi. p. 135.

Aneurism.

Aneurism of the renal artery occurs both from embolism and as the result of atheroma. I have elsewhere (p. 702) related a case in which extravasation of blood about the kidney external to the pelvis was attributed to the bursting of an aneurism of embolic origin, and M. Ollivier[2] has given an instance, which probably must be regarded as exceptional, in which discharge of blood with the urine repeated during the course of six years was found to be associated with atheromatous aneurisms of the renal artery and its branches. An aneurism as large as a filbert was found at the bifurcation of the renal artery, while on the further branches were smaller aneurismal dilatations, the bursting of which into the dilated pelvis had apparently given rise to the repeated hæmorrhages. Pyelitic symptoms not unlike those of stone had been produced by the irritation and obstruction caused by coagula in the pelvis.

Renal vein.

With regard to disease of the renal vein, it is not needful to say more than has already found mention under the heading of Thrombosis.

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[1] 'Aneurism of Superior Mesenteric Artery compressing both Renal Arteries.' Dr. Burney Yeo, *Path. Trans.* vol. xxviii. p. 95.

[2] 'On an Undescribed Variety of Pyelo-nephritis,' by Auguste Ollivier, *Arch. de Physiologie*, 1873, vol. v. p. 43.

CHAPTER XVIII.

RENAL PARASITES.

The parasites which have been recognised beyond doubt in the human kidney are but four—the *Echinococcus* or *Hydatid*, the *Bilharzia hæmatobia*, the *Strongulus gigas*, and the *Filaria sanguinis hominis*. The *Pentastoma denticulatum* is stated to have been seen in the kidney, and the *Tetrastoma renale* to have come from it. Beside these, the *Dactyleus aculeatus* and the *Filaria piscium*, under the title of *Spiroptera hominis*, have been produced as urinary parasites, but there is every reason to believe that their appearance in this relation is the result of accident or fraud. The filaria will be considered in the next chapter in relation to chyluria.

Hydatids.

The only parasitic cyst which has attracted notice in the kidney is the Echinococcus or Hydatid: the cysticercus cellulosæ is widely scattered throughout the body, and it is scarcely to be supposed that the kidney enjoys an exemption from its attacks, but I cannot find that cysts of this nature have been recognised in this situation.

General description of their origin, nature, and distribution.

It is not necessary that I should recapitulate what is to be found in every text-book with regard to the genesis of the hydatid. This is the cystic stage of the minute tænia echinococcus, which, in its phase as an intestinal worm, belongs only to the dog and the wolf, though in its cystic or hydatid form it infests many animals, of which the human being is one. It is curious that this tape-worm, which is one of the smallest of its race—it consists of but four segments and is altogether only of about the size of a millet seed—should engender, in the shape of the hydatid, the largest parasitic growth to which the human body affords residence. The eggs of the tænia pass with the fæces from the bowels of the animal, and are conveyed into human food with a frequency corresponding with the intimacy which exists between man and 'the faithful dog which bears him company.'

In Iceland, where dogs are necessary and numerous—each peasant has on an average six—and where men and animals are closely associated with little distinction of persons, hydatids are said to be fatal to one-seventh of the population. The spread of the disease is assisted by the strictly homœopathic practice of the Icelandic quacks, whose favourite remedy for internal administration is dog's dung, or, as it used to be called, Album Græcum. It is easy to imagine, also, how the ova of the tænia may be conveyed by water into which dogs' excrement has passed, or may cling to various articles of diet or culinary utensils where cleanliness is unknown and dogs ubiquitous.

The hydatid disease is known also to prevail largely in Silesia, where it has been attributed to the use of dog's flesh as food: tænia, or their eggs, probably escape from the bowel in some of the butchering processes, and contaminate the edible portions of the animal. By such means some of the ova of the tænia, which are very numerous—about 5,000 in the last or only fertile joint of the minute worm—are carried into the alimentary canal of the animal destined to lodge the hydatid, and thus enter upon a new phase of existence. The eggs each contain a minute six-hooked embryo, whose occupation appears to be that of fixing upon and boring through the structures in contact with which it finds itself. It is difficult to suppose that the tissues are traversed by any effort or design on the part of the embryo; more probably its translation is accomplished by some such process as that by which needles travel from one part of the body to another. The movements of the parts of the body on each other must necessarily tend to produce the frequent displacement of the germ, while the hooks prevent its movement save in one direction. Should a vessel be penetrated by this process, the embryo is of course liable to be swept in its current, and implanted in one of the capillaries to which it leads. Should the situation reached by one means or another be suited for its development, the hydatid will here spring from the tape-worm germ. And should the flesh holding the hydatid become the food of a dog, its germs may reproduce the tænia in the bowel of the animal, and thus carry on the eternal interchange between intestinal worms and cystic tumours.

Thus it appears that two animals in succession, and those of the nobler species, are required to minister to the engendering of a tape-worm. It is a little puzzling why tæniæ and hydatids should not flourish within the same creature: why should not the eggs which must abundantly escape from the tæniæ in dogs' bowels start on their travels there and then, and develope into hydatids within the same animal? They do not do so On the contrary, the eggs must form the food of another individual, usually of a different species, so that the tape-worm is proper to certain animals, its cystic successor to other and different animals. The dynasty is continued only by the eating of the flesh which contains the cyst by the animal who inherits the tape-worm. Thus the worms commonly belong to flesh-feeders, the cysts possibly to animals which live on vegetables. The germ which belongs to the hydatid can scarcely be introduced but with the eating of flesh, while the eggs of the worm, being detached as excrement, may cleave to anything. It is to be observed that at each transfer the egg, or the cystic germ, as it may be, is exposed to the process of digestion—usually a destructive, but in the case of these parasites a vivifying process.

The proper hydatid cyst, supposing it to have been produced within a parenchymatous organ, is surrounded externally by a concentric layer of tough fibrous tissue, which is derived from the organ itself. Within this comes the parasitic formation, the wall of which has been divided into two portions, described as the *ectocyst* and the *endocyst*. The outer portion, or ectocyst, is thick, elastic, and laminated, but otherwise homogeneous. It is this portion of the cyst which is so readily recognisable as hydatid membrane. The inner layer, or endocyst, is excessively thin and delicately cellular; it appears to represent the germinal membrane or essentially vital part of the animal, and to supply the surface by which the characteristic fluid is secreted. From this membrane grow, and push inwardly, what have been described as *daughter cysts* or *brood-capsules*, as part of which *scolices*,[1] or rudimentary tape-worm heads, after a time develope.

These heads, which are not six-hooked like the embryos, but armed, like the mature worm, with a complete and formidable circle of hooklets, are little else than tape-worms in brief, and are prepared to complete themselves whenever a fitting situation presents itself.

For this opportunity they are indebted to accident, and to the catholic appetite of the dog. The vast majority must perish with a destiny unfulfilled, but those that find fruition and completion do so in the duodenum and upper small bowel of that animal of whose food they have made part. From the tape-worm matured in this situation the circle recommences. The scolices or hooklets which have been derived from them are continually found floating loose in the hydatid fluid, where their presence, easily detected with the microscope in small portions withdrawn with the hypodermic syringe or aspirator, furnishes ready and conclusive evidence of the nature of the cyst. But it is to be observed that these creatures are not naturally thus detached. Dr. Cobbold, whose account I have chiefly followed, points out that their separation from the brood-cysts, however frequent, is a result of accident, and is attended with the death of the animalcule which has been thus cast loose.

The hydatid fluid is aqueous and slightly saline, in its uncomplicated state quite devoid of albumen. The saline matter is chiefly chloride of sodium, though organic salts of soda have been found in it, and also crystals of cholesterine and of hæmatoidin. In renal hydatids have been noticed, special renal products, such as crystals of uric acid, of oxalate of lime, and the phosphates. The absence of albumen is by no means invariable; indeed, after each tapping of a hydatid cyst the fluid will become more and more serous in character, until at last it is highly so. Finally, it may suppurate and be converted into an encysted abscess full of liquid pus, or the fluid portions may be gradually absorbed, to leave a shrunken semi-calcareous nodule, in which the shrivelled remains of the secondary cysts are flattened and folded together, embedded in the earthy residue.

Hydatids affect different organs with very different frequency. Dr. Cobbold, placing together his own researches with those of Davaine, gives the following statement of the number of times they have been found in the several situations they frequent:[1]—

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[1] σκώληξ = a worm.

Organs affected	Cobbold	Davaine	Total
Liver	161	165	326
Abdomen, pelvic cavity, and spleen . .	45	26	71
Lungs.	22	40	62
Kidney and bladder	23	30	53
Brain	22	20	42
Bones	16	17	33
Heart and pulmonary vessels . . .	13	12	25
Miscellaneous	25	63	88
Grand total	327	373	700

The liver becomes the seat of the parasite far more often than any other organ; about as often as all the rest of the body together. This organ is affected about five times as often as the lungs, which stand next in order of frequency, about six times as often as the kidney, which has the next place. After the liver there is no marked difference between the important organs. The comparative frequency with which the liver is attacked, being, as it is, the recipient of all the blood which returns from the alimentary canal, cannot but suggest that the blood is largely concerned in the distribution of the ova. Ova have indeed been detected in the blood of the abdominal veins, after the experimental feeding of an animal with tape-worm joints.[2]

If one of the ova, on its way from the bowel, should enter a vein, the liver will, as it would seem almost inevitably, be the place of its arrest; it is not to be supposed that the hooked embryo could by any process short of boring traverse the capillary system of this, or indeed of any, organ. The probably constant arrest of the blood-borne ova in the liver, and their corresponding exclusion from the general venous blood, explains the position of the lung with regard to the distribution of hydatid tumours. The lung is not exempt from them, but shares only equally with most other organs. Did these germs in any appreciable proportion pass through the liver, and thus enter the systemic venous circulation, the lung, as presenting a capillary obstruction which must be traversed before any other organ is reached, would probably be affected, as in the case of pyæmia, incomparably more often than any structure which receives only a subsequent and fractional supply. But this is not the case. We may therefore infer, in the first place, that the eggs which come by the portal vein stop in the liver, and that the lungs, kidneys, brain, and other organs all receive, by some mode of distribution which is independent of the course of the blood, from the alimentary canal: whether the germs penetrate the aorta and are thus distributed with the arterial blood, or whether they scatter themselves by an impartial system of burrowing, remains to be seen.

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[1] 'Lecture on Hydatid Disease,' by Dr. Cobbold, *Lancet*, 1875, p. 850.

[2] Experiments by Leuckart upon the generation of the *Tænia serrata*, quoted by Cobbold, p. 109.

The hydatid disease affects most frequently the middle of life, though perhaps no part of its course can be asserted to be absolutely exempt. Hydatids have been found in the kidneys of the fœtus, but they appear to be almost unknown in infancy. They attain their greatest prevalence between thirty and fifty, but are known up to old age. The cases of hydatid of the kidney collected by Roberts—forty-seven in number—gave a mean age of thirty-four; the youngest subject was four, the oldest seventy-five. This statement corresponds with and evidently includes results obtained by Beraud from forty-two cases.

Hydatids in general appear to be distributed between the sexes with much impartiality, though in Iceland women appear to be affected more often than men, probably in consequence of the closer confinement of the former to their dwellings, and more constant use of the water which dogs are liable to have fouled. With regard to the kidney in particular, and the disease as we know it in less extreme latitudes, men suffer more often than women in a proportion, as Dr. Roberts reckons, of about two to one. Of sixty-three cases collected by this author, the subjects of forty-one were males, of twenty-two females. Of Beraud's cases, forty-nine in number, twenty-nine related to males, twenty to females.

Hydatids localized in the kidney.

It is rare for both kidneys to be affected with hydatids: the left is so rather more often than the right. Of 42 cases collected by Dr. Roberts, both kidneys were attacked in but two; of the rest, the left was the seat of the disease in twenty-two instances, the right in eighteen.

Hydatid cysts are apt to be imbedded in the proper glandular substance of the kidney, either in the cortex or the cones, and to present themselves, or possibly to originate, in the cellular spaces under the capsule and around the pelvis. The renal tissue undergoes various degrees of atrophy from pressure, the remnant often presenting, as when pressure is due to any other cause, a positive or relative excess of fibrous tissue.

Their effects upon the organ.

Hydatid cysts in connection with this organ vary in size from an exceeding minuteness to such a magnitude as to hold three pints or more.

Many cysts of different sizes often exist together: in Baillie's case they were described as varying in size from an orange to a pin's head. When of considerable size they have a great tendency to open into the pelvis, which leads to the discharge of hydatids with the urine, which is so common and so characteristic of this disease. The orifice by which the cyst opens upon the pelvis may be comparatively small: in a case under Rayer, recorded by Beraud, it had a diameter of half a centimetre.[1]

Resultant tumour.

It is stated that about half the instances of renal hydatids have attained such a size as to be appreciable as tumours during life; at least one instance has been known in which the tumour was regarded as ovarian,[2] and an operation performed in this view, and another in which it gave rise to a suspicion of pregnancy.[3]

From the last case it would appear that hydatid growths may be large enough to cross the median line, but usually they do not go beyond the half of the body in which they have originated. They are usually globular.

A growth of this nature in the kidney is commonly painless and unattended with febrile symptoms or any constitutional disturbance. The prominent signs of the disease apart from the tumefaction are usually to be found in the escape of the hydatids by the urethra, or possibly by the urethra together with some other exit. Hydatids, or pus [1] from a suppurating hydatid cyst, carrying with it shreds of membrane, have been known to make their way from the kidney both into the bladder and into the bronchial tubes, so that the contents of a hydatid cyst of renal origin have been expectorated and passed by the urethra by the same person. The tendency of a renal abscess, upon whatever it may depend, to burrow behind the diaphragm and into the root of the lung, is one of the prominent facts in renal pathology. Hydatids, presumably renal, have been vomited—a woman who had a tumour in the side, and habitually passed these cysts by the urethra, vomited a large quantity.[2] It has more often happened that the urethral exit has been associated with one by the bowel; several instances have been put upon record in which hydatids have simultaneously made their way out by both these channels, but either they have not terminated fatally or no post-mortem has been performed, so that the site of the formation must remain in question.[3]

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[1] Beraud, *loc. cit.* p. 22.

[2] Spiegelberg. Quoted in Ziemssen's Cyclopædia, vol. xv. p. 753. An operation intended as ovariotomy exposed a hydatid cyst of the kidney of the size of a man's head; it was surrounded by firm and numerous adhesions. The tumour had been developing for one-and-a-half years in the right hypogastrium.

[3] Case related by Dr. Babington, *Med. Times*, 1855, p. 160.

Exit by different channels.

It is to be observed that presumably renal hydatids, becoming as they do the centres of suppuration, travel out of the kidney much as do calculi, which are apt to burrow their way out by the agency of the same penetrating process.

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[1] See case of Mme. B——, which occurred in the practice of M. Fiaux, related by Mr. Beraud, *loc. cit.* p. 63. A hydatid cyst of the right kidney presented these two openings with the results described. The case ended fatally, and post-mortem examination was performed. An instance is related by Rayer (*loc. cit.* vol. iii. p. 323) in which the pus from a suppurating hydatid cyst connected with the left kidney burrowed behind the diaphragm into the base of the lung, and was thence expectorated.

[2] Schmidt, *Jahrb.* Bd. 87, p. 205, quoted by Roberts. Also quoted by Beraud, *loc. cit.* p. 70.

[3] A case is related by M. Rayer, vol. iii. p. 552 footnote, in which a man who had a tumour in the left iliac fossa passed hydatids by the bowel, pus and gas by the urethra. The same author, vol. iii. p. 554, quotes from M. Fourcroy the case of a perruquier who after a debauch passed blood and hydatids by the anus, hydatids with the urine. The patient recovered.

The case of a woman is quoted by Davaine (*loc. cit.* 2nd edition, p. 529) in which a tumour appeared in the right flank after an effort, and subsequently hydatids and pus were discharged both with the motions and urine. The patient recovered after nine and a half months' illness.

Points of difference are, however, to be observed in two notable respects. Suppuration in connection with a stone sometimes breaks into the peritoneum: this issue has not been recorded in regard to hydatids or a hydatid abscess. Matter of calculous origin, and calculi themselves, will sometimes make their way out through the back; this mode of escape has never been verified with regard to renal hydatids. Several instances have been recorded in which hydatids have been discharged superficially from the lumbar region, but proof is wanting of their renal origin;[1] in one instance indeed, in which a post-mortem was made, they were found to have come from outside the kidney.

Roberts, to whose research in this subject all subsequent writers are likely to stand indebted, thus analyses, with regard to their mode of opening, sixty-three cases in which hydatids were found in the kidney or passed by the urethra.

The cyst opened into the—

Pelvis of the kidney	in	47	cases.
Pelvis of kidney and lungs	,,	1	,,
Pelvis of kidney and intestines	,,	3	,,
Pelvis of kidney and stomach	,,	1	,,

Hydatids discharged by urethra in 52 cases.

Lungs alone	,,	1	,,
Did not open at all	,,	8	,,
Opened artificially	,,	2	,,

No hydatids discharged by urethra in 11 cases.

Escape with the urine.

In the majority of cases in which hydatids are formed in the kidney it appears that some of them habitually escape with the urine; the tendency of renal hydatids to break into the pelvis is, indeed, the characteristic by which the affection is generally recognised. Of presumably renal hydatids Roberts estimates this result, as has been seen, at 47 of 63 cases. Beraud estimates it at 48 of 64. But it is to be borne in mind that all hydatids that thus escape are not of renal origin. They may thus make their way out, and that abundantly, though the cyst belong elsewhere. In a case under Mr. Birkett, referred to at page 1073, hydatids obtained from the bladder by means of a catheter were found to have proceeded from the cellular tissue behind it. A number of cases in which hydatids were passed by the urethra were brought together in the 'Medical Times,'[1] with an expression of belief on the part of the compiler that in most the parasites were derived, not from the kidney, but from the cellular tissue in some part of the abdominal or pelvic cavity.

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[1] See case quoted by Rayer, vol. iii. p. 578.

But however often hydatids are thus connected with the cellular tissue, we have abundant post-mortem evidence of their occurrence within the kidney itself. A preparation at Guy's Hospital which shows a hydatid cyst springing from the hilum and pressing into the pelvis illustrates the first stage of the process; while the last is displayed by another at St. Bartholomew's, which consists of an ovoid mass of cretaceous matter, scarcely to be recognised as a kidney, but being all that was left of this organ in a man who for ten years had passed hydatids by the urethra.

The series of cases to which I have referred contains a curious instance in which a husband and wife were both in the habit of passing hydatids with the urine.

This mode of getting rid of renal hydatids is often preceded by a sensation of something having broken in the lumbar region, and been immediately attributed to a blow or fall or jolting movement. The attack resembles the ordinary form of renal colic which attends the passage of a stone, but is less acute than the latter often is. The pain begins usually about the hip, and passes down the line of the ureter into the thigh. The testicle is often retracted. The process is often preceded or attended with hæmorrhage. These attacks are often attended with obvious lessening of the renal swelling. Mr. Evans, of St. Neots,[1] described a case in which a lobulated tumour, which presented through the integuments the dimensions of eight inches by four, totally disappeared after successive discharges of hydatids with the urine. Many hundred cysts of this nature were voided in one day.

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[1] January 1855, p. 159. See also *Med. Times*, 1863, vol. ii. p. 164.

The hydatid outbreaks are often separated by considerable intervals—a year or more—as if the cavity were emptied and refilled by slow growth.

Having reached the bladder, the hydatid may cause temporary retention of urine, and give occasion for the use of a catheter; or they may be shot out of the urethra with considerable force. Women have been known to release the skins from the orifice with the fingers. The hydatid skins do not, as a rule, appear to have a very irritating effect upon the bladder, though occasionally some degree of cystitis, with a discharge of mucus or pus, has been traced to their influence. More often the urine contains pus which is of renal origin, being discharged from a suppurating cyst in process of natural cure. Hooklets and cretaceous material have been found in the pus thus produced. Not only may retention of urine, though usually in this case of a passing nature, result from the transit of renal hydatids, but fatal retention has in at least one instance been produced by hydatids not of renal origin. The neck of the bladder was pressed upon by a growth of this nature belonging to the cellular tissue between the bladder and the rectum, and the use of the catheter delayed until it was too late.[2]

It is scarcely necessary to say that, as in the case of renal tumours in general, the urine is unaffected so long as there is no discharge of the contents of the cyst into it.

Calculi sometimes occur in the same kidney with

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[1] Related by Dr. Barker, of Bedford, 'On Cystic Entozoa of the Human Kidney,' p. 11.

[2] Related by Mr. Birkett, *Med. Times*, 1855, p. 161.

Association of calculi with hydatids.

hydatids, apparently as secondary productions. Crystals of [1] triple phosphate, oxalate of lime, and uric acid, have been found within hydatid cysts passed with the urine, and it is easy to suppose that such a discharge may either establish phosphatic deposition as a consequence of the mucous irritation which it involves, or may simply furnish the nuclei on which any urinary deposit may collect. Chopart [2] found in the pelvis of the kidney of a child four years old hydatid cysts, or what were thus described, some of which contained a stone as large as a pea, evidently phosphatic, in their interiors. Stones of the same character were found in the bladder. In Blackburne's instance presently referred to, in which there was but one kidney, and that the seat of hydatids, its pelvis contained a stone.[3] And other instances of a similar association might be referred to.

Paraplegia.

Paraplegia has been noted concurrently with hydatids of the kidney. Instances have been recorded in which the leg and the kidney of the same side have been affected.[4] A case is related by Dr. Richardson as having come under the notice of Mr. Mackinder, of Gainsborough,[5] in which a woman who had paralysis of the lower extremities and bladder was found after death to have hydatids in the liver and both kidneys. It is not to be supposed that there is any but an accidental connection between the renal parasite and the spinal failure. The spine may be diseased independently and differently. Or it is possible that the spinal canal, as it proved to be in a paraplegic patient not long ago under my care in St. George's, may itself be the seat of a hydatid formation. Apart from such chances it is unlikely that a renal hydatid should affect the spinal cord. A cyst of this nature cannot encroach by filtration like a malignant tumour; and our knowledge of renal abscesses shows it to be highly improbable that even should the cyst suppurate the matter should penetrate the spine or in any way affect the cord.

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[1] Found by Mr. Quekett in case reported by Dr. Barker, *loc. cit.* p. 10.

[2] Chopart, *Traité des Maladies des Voies Urinaires*, vol. i. p. 145. Paris, 1830. It is not improbable that, though these cysts are described as hydatids, they may have been cavities of some other nature. At the date of this account the distinction was not clearly made.

[3] See footnote, p. 1076.

[4] Ziemssen's Cyclopædia, vol. xv. p. 751, quoted from Frerichs.

[5] *Lancet*, 1855, vol. ii. p. 366.

Diagnosis. With regard to the diagnosis of renal hydatid, this condition can scarcely be assured but by the passing of hydatids or hooklets with the urine while a tumour of renal situation is recognised. The latter will be distinguished by the rules which have already been laid down, which should suffice to distinguish a renal from an ovarian cyst the more surely when, as in case of hydatids, the formation in question is never of such large size as to obscure its relations. In case of otherwise insoluble doubt the aspirator may be resorted to. The character of the fluid withdrawn might at once determine between the two. The presence or absence of albumen must not be solely relied upon: hydatid fluid, though not usually albuminous, may be highly so, and conversely cysts other than hydatid may be aqueous. The finding of hooklets or laminated membrane would of course be conclusive. The hydatid fremitus is seldom if ever to be detected in connection with the kidney; it is probable that the tumour is seldom superficial enough to transmit vibrations from the cyst to the surface with the necessary distinctness.

Duration. It is not possible to state the duration of hydatid of the kidney more exactly than as variable, sometimes very brief, sometimes apparently unlimited. The cysts are apt to escape by the urethra in successive crops, separated by considerable and uncertain intervals, so that it is difficult to say that any one is the last, notwithstanding that even years may have elapsed since its occurrence. One of the longest cases of the sort on record is one quoted by Beraud[1] from M. Vigla. A woman 37 years of age had passed hydatids with the urine every year of her life; she had had an attack lasting about four days every winter, mostly in January, with now and then others at odd times. A woman mentioned by Davaine,[1] whose left kidney after death was found to have been transformed into a bag of hydatids, had been liable for twenty years to attacks of renal colic with escape of the cysts by the urethra. The case quoted from Blackburne[2] by the same author, in which the disease attacked a solitary kidney, proved fatal in four years. Many instances of a different kind have been placed on record in which the patient has apparently recovered after a few outbreaks or even one. A natural cure is sometimes brought about by the process of suppuration. This finally arrests the cystic growth by killing the parasite, and leaves an abscess which may at last cure itself by discharge.

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[1] Beraud, *loc. cit.* p. 57.

Natural terminations and mortality

Hydatid of the kidney, as already stated, is less fatal than when single organs or organs which have no such ready exit as the ureter affords are the seat of the disease. Of the cases recorded only a minority have terminated fatally; and of those some have done so from causes unconnected with the growth which in several has presented itself as a post-mortem surprise. Relying, as we must do in dealing with a disease of the infrequency of this, more upon published records than personal experience, it follows that the proportion of fatal cases should appear larger than it is. Those which present this ending are more noticeable than many which do not; some instances are brought to light only by post-mortem examination, so that it is inevitable that cases which are completed by death must show a larger proportion in literature than in nature. But even in literature it is not very great. Of sixty-three cases collected by Roberts, recovery was assumed to have taken place in twenty. Twenty terminated fatally, but in nine of these death was brought about otherwise than by the hydatid disease, so that this affection caused the death of but eleven of the number.

The tendency of renal hydatids, as has been shown, is to break into the pelvis and wear themselves out by discharge while the functions are sufficiently carried on by the kidney, which does not participate in the disease. But if this be incapacitated by any simultaneous or preceding accident, or if, as in Blackburne's case, the affected kidney be solitary, fatal results may be brought about by partial or complete suppression of urine, and in the rare instances where both kidneys have been involved in the hydatid disease the same issue may present itself. Fatal results have followed the opening of the cyst [1] into the bronchial tubes, and have also been known to occur from extensive pleural effusion,[2] set up by the progress of the growth in the same direction. Death has been known to have been brought about by the exhaustion of a purulent discharge with the urine derived from a defunct hydatid cyst, and also to have ensued, as more often happens in the case of the liver, from the formation of a closed abscess in the place of one.

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[1] Davaine, *loc. cit.*, p. 551.

[2] *Ibid.* p. 551.

In a case under M. Nélaton, related by Beraud,[3] a fatal conclusion followed the artificial opening of a renal hydatid cyst: the cyst, which lay in close relation to the bowels, and had contracted extensive peritoneal adhesions, was punctured by means of caustic. It is difficult to say in this case how far the result was due to the disease and how far to the remedy. In other instances death has followed upon senile gangrene, phthisis, or some accident not obviously connected with the parasitic affection.

Treatment.

The usually favourable delivery of renal hydatids makes it unjustifiable to encounter risk in search of artificial cure, save in the presence of circumstances which add exceptional danger to the condition. What can be done beneficially may be briefly stated. Vermicides administered by the stomach appear to be powerless as regards parasites in the tissues. This is made evident in the case of the liver, an organ which is more advantageously situated than any other to receive the influence of drugs introduced into the stomach and admitted into the system probably by the portal vein. Hepatic hydatids flourish in contempt of all such modes of attack; and there is no reason to suppose that such growths elsewhere will yield to them, exposed as they are only in a remote degree.

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[1] Davaine, *loc. cit.* p. 467.

[2] Davaine, *loc. cit.* p. 550. Quoted from Livois.

[3] Berand, *Des Hydatides des Reins*, p. 80.

I have satisfied myself that the oil of male fern is useless in this relation; and though many instances have been reported in which discharges of hydatids with the urine have ceased after the use of turpentine, there is no reason to believe that they would not equally have come to an end, transitory as their nature is, had this drug not been given.[1]

The question of surgical treatment can arise only in those few cases where a tumour presents itself near the surface. And even with such, if no danger obviously threatens, if there be no embarrassment of renal function, no rapidity of increase, and no sign of thoracic complication, we may generally be content to wait upon nature. If there is reason to interfere it would probably be best to use the method so often and so successfully used with regard to the liver: puncture the cyst, where it is least covered, with a very fine aspirator, and with it draw off much, but not necessarily all, of the fluid contained. This will at least be a measure of relief, and with repetition it may be curative; for the contents of the cyst, at first aqueous, will become more serous with each renewal until at last they are so much so as to constitute an element in which the parasite cannot live; the solid structures belonging to which will gradually shrink, concrete, and become inert. This method causes less pain and constitutional disturbance than that which has been of late employed under the name of electro-puncture, and is probably safer than it. I have tried both with hepatic hydatids, and have no hesitation in preferring the former.

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[1] See case of apparent recovery after the use of turpentine under Mr. Curling, *Med. Times*, 1863, vol. ii. p. 164.

A single puncture, and that without the removal of fluid, or with the removal of but a trifling quantity, has been known to be followed by rapid diminution of the tumour. The larger methods, which seek the extraction of the cysts, *in propria persona*, by trocar, caustic, or incision, are scarcely likely to suggest themselves with regard to cavities seated as deeply as in the kidney.

Apart from the evacuation of hydatids from without, the fact that their escape into the pelvis and so out has been determined by blows and falls must be recognised; but such natural surgery—surgery not of the surgeon—would be too uncertain in result to be recommended even were it possible, which it perhaps never is, to diagnose as renal a non-discharging hydatid.

Measures of palliation are thus on every ground more likely to be called for than such as aim at cure. The vesicles have been helped along the ureter by external pressure directed by the patient himself, and their removal from the bladder has often been assisted with the catheter. This instrument will of course be at once resorted to should there be any distress from retention of urine. The use of diuretics has been thought to facilitate the discharge of the cysts; Beraud[1] found in one case that these escaped after nitre or white wine; but probably such remedies will bring away only cysts which would as surely escape without them. During the attack, should it be attended with much pain, such treatment—opium, warm baths, &c.—may be indicated as would be proper were a calculus in transit.

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[1] *Loc. cit.* p. 93.

BILHARZIA HÆMATOBIA; DISTOMA HÆMATOBIUM; DISTOMA CAPENSE.

ENDEMIC HÆMATURIA.

General distribution of endemic hæmaturia.

It has long been known that several parts of the old world, most notoriously the island of Mauritius, but also certain districts belonging to the continent of Africa, including Egypt, especially the valley of the Nile, and also the southern extremity of the same quarter of the globe, comprising the Cape of Good Hope and Port Natal, are the seats of an endemic disorder of which hæmaturia is a prominent symptom. The hæmaturia of Mauritius has been longest under notice, and its symptoms have been minutely and repeatedly described, so as to leave no doubt that the disease is of the same nature as that which prevails on the continent; yet it has been imperfectly traced pathologically, and though it is said that the Bilharzia[1] has been found in the island, yet it must be allowed that the nature of the insular endemic is rather a matter of inference than demonstration.

The corresponding affections of Egypt and the Cape have been more completely worked out, owing to the labours chiefly of Bilharz at Cairo and of Dr. John Harley in regard to the southern localisation, and followed in both these widely-removed fields to identically the same cause, the ravages of a minute bloodworm, with which the name of its discoverer has been connected. It is hardly to be supposed that the intermediate portions of Africa are entirely destitute of the parasite which infests its extremities; and indeed it is believed that the animal frequents the whole of the eastern seaboard of this continent, manifesting a preference for littoral rather than the inland districts, and for low rather than high levels. Further research must add to our knowledge of the distribution of the disorder; but we know enough already to make it impossible to consider the hæmaturia of Africa excepting in relation to the parasite; and as to the hæmaturia of the Mauritius, it is so similar in symptoms to that of Africa that it can scarcely be of a totally different nature. The consideration of the Bilharzia, therefore, is inseparable from that of endemic hæmaturia, and it may be convenient to sketch in slight outline the natural history of the parasite before referring in particular to the symptoms which it has been ascertained to produce, or which are presumably associated with a similar cause. Our knowledge of the animal in its Egyptian location has been largely contributed to by post-mortem research, and is fairly complete so far as relates to the portion of its existence during which it is a denizen of the human body; as yet we know it at the Cape chiefly by ova which have been passed with the urine during life; it is possible that our knowledge in this respect may soon be extended.

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[1] Sonsino, *Lancet*, May 27, 1882, p. 553.

The Bilharzia; its nature, habits, and distribution.

The animal whose existence was discovered by Bilharz in the year 1851, and since described by Kuchenmeister and Leuckhart, is a distinct species of fluke or trematode.[1] The creature enjoys complete sexual distinction: the male, which has much the contour of a leech, is about half an inch in length; the female measures about four-fifths of an inch, but is of such slender proportions that much of its body is imbedded within that of the male during the act of sexual association. The body of the male contains a canal which has been called *gynecophoric*, within which nuptial chamber the female is for the time enclosed. The comparatively plump body of the male is somewhat tuberculated, that of the female is smooth. With both sexes there are oral and ventral suckers, by means of which the animal secures its position. The eggs are oval or pear-shaped. They have a spine or sharp point, usually at the hinder extremity, but sometimes at the side. Dr. John Harley found in his South African cases the hinder spine only; in Egypt both kinds have been found. According to Dr. Zincarol,[1] of Alexandria, the ova from the bladder have a terminal spine, those from the intestine a lateral one. The eggs give exit to ciliated embryos, which move about with much activity, as Griesinger witnessed in the bowel, and as has been often seen in the urine.

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[1] Cobbold, *loc. cit.* p. 197.

Though the eggs may possibly be thus hatched in urine, the embryo cannot live long in this fluid; water is the place of its further development. For its prolonged existence pure or only brackish water is required. Urine is fatal to it, though not at once. Harley never found a live embryo in this fluid. Roberts was more fortunate, and witnessed the activity of the embryo in this secretion several hours after it had been emitted; but we have the evidence of Cobbold as to the impossibility of preserving its life for forty-eight or even for twenty-four hours, excepting in water which is free from organic admixture. Traces of blood, mucus, or decomposing matter of any kind added to spring water caused the death of the embryo within twenty-four hours, as also did a mere tinting with permanganate of potash or carmine. So small a proportion of urine as a drachm to a quart was fatal to the embryo in forty-eight hours.

Thus it appears that for the continuance of the race the egg or embryo must be passed with the urine into fresh or brackish water; if the egg, it is hatched, as Cobbold has shown, almost immediately upon coming into contact with the water; and it then commences the extra-human portion of its existence, of which nothing is ascertained except that a time comes when the creature, in some shape as yet unknown, returns from the water to the vertebrate body.

The parasite infests man and the monkey. A variety, which is stated to be distinct, has been found in the ox and sheep. In the portal vein of a monkey which had been imported from Africa and died in the Zoological Gardens, Dr. Cobbold found so fine a specimen of this fluke that he was for a time disposed to distinguish it as the Bilharzia magna.

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[1] *Path. Trans.* vol. xxxiii. p. 110.

Adult Bilharzia found in blood-vessels.

The animal in its adult state belongs especially to the blood; it is found particularly in the vessels of the bladder, and in the abdominal veins, the portal vein and its intestinal, mesenteric, and splenic tributaries, and the hepatic vein.

Ova especially in intestinal and urinary mucous membranes.

Ova have been abundantly found in the liver, to which it is evident that they may readily be conveyed; and egg-shells within the left ventricle, the means of their reaching which are less obvious. Though the worms are, as a rule, confined to the blood, the eggs are somewhat widely distributed. They are deposited mainly in the mucous membranes of the bowel and of the urinary system, in which they give exit to the ciliated and active embryos which escape with the evacuations to find adventures as yet unknown to us, but no doubt to provide adequately for the continuance of the race. The worm in the blood appears to cause less disturbance than would be expected; the presence of the parasite is chiefly made known to us by the irritation occasioned by its progeny in certain mucous membranes. In the large intestine, which is the part of the bowels chiefly affected, the ova were found in polypoid excrescences, and their presence indicated by diarrhœa, with discharge of mucus and blood, and much pain of the nature of colic. In the urinary membrane, which is the chosen site for the deposition of the eggs, the results are produced by which the disorder is especially characterised. The bladder is found to be extensively spotted with ecchymosis, and variously pigmented; the mucous membrane is sometimes partially detached or undermined by accumulations of eggs beneath it, and it is sometimes lifted up into warty or villous elevations. These changes are necessarily attended with much irritation and the discharge of blood and mucus, together with eggs, embryos, egg-shells, and now and then a deceased parent.

Pathological results.

The accumulated and partially imbedded ova often become the centres of oxalic and lithic deposits from the urine, so that vesical calculi are common complications of the parasitic disease. Similar changes occur in the lining of the ureters, and, less often, of the pelves. The ureters are apt to become obstructed or constricted, and the kidneys to present in consequence the various phases of dilatation and atrophy which follow upon urethral stricture. They may become the subjects of hydronephrosis, or there may be pyelitis even to the degree, as in a case described by Griesinger, of converting the organ into a mere bag of pus. But beside these consecutive changes it appears that the kidneys are affected by the parasitic disorder in ways which arise within themselves. It is sufficiently clear that the pelvis of the kidney affords lodgment to the ova, as do other parts of the urinary membrane, though not with the same frequency, and adult animals have been found in the renal blood-vessels. Whichever may be the effective sources of irritation, the kidneys are described as swollen and congested, affected with a dark red hyperæmia, and, in the later stages, fatty. Whether these changes depend upon venous obstruction or upon irritation of the renal substance by parasitic intrusion are questions which must be answered by further observation.

Concurrence of filaria.

Both in Egypt and also in a person who had come from Natal, filariæ[1] have been found in individuals who have also given residence to the Bilharzia; but the animals and the symptoms produced by them are totally distinct and the concurrence accidental.

Symptoms.

We know the symptoms of the disorder as it occurs in Egypt, chiefly from the researches of Bilharz and Griesinger, as in South Africa chiefly from those of Dr. John Harley, though as regards both localisations many other observers have more recently added to our stock of knowledge. 'Gravel and ulcers of the kidneys,' if we may trust the statement of Prosper Alpinus,[2] appear to have been

[1] Zincarol, *Med. Times*, January 21, 1882, p. 76. Cobbold, *Lancet*, January 14, 1882, p. 84. Sonsino, *Med. Times*, May 27, 1882, p. 552.

[2] Quoted by Davaine, 2nd edition, p. 320.

frequent among the Egyptians even as far back as the year 1645—not to mention a still older reference to the turning of water into blood, which may have found its suggestion in the diseases proper to the place. So common is the parasite in Egypt that M. Griesinger found it in 117 of 363 autopsies. Its effects are most noticeable from June to August, and least so from September to January. The prevalence of the disease in summer is owing, as Dr. Cobbold supposes, to the prevalence of the larvæ, whencesoever derived. The symptoms of the disease are, in the first place at least, chiefly local, vesical, and prostatic irritation, with the passing of blood, mucus, sometimes pus, and not seldom calculi, which may be either of vesical or renal origin. Pain in the back is mentioned, though the bladder-symptoms appear to be usually more prominent than the renal. A form of dysentery, diarrhœa with the passing of blood and mucus, is a frequent concomitant. With the local symptoms there is often much loss of flesh, anæmia, and nervous prostration. 'Egyptian chlorosis' has been spoken of as one of the results of the disease, but it appears that this especial affection is rather to be attributed to another parasite, the *Anchlistoma duodenale.*[1] Beside dysentery, pneumonia has been mentioned among its fatal results, though it would seem from our experience in South Africa that the disorder seldom leads to a fatal issue. It is stated that in Egypt it occasionally presents itself in an acute constitutional form, resembling typhus in its symptoms and duration. The symptoms appear, however, to be usually, and as far as we know in South Africa always, of the chronic and local sort, with hæmaturia and vesical or prostatic irritation, without much or with no early effect upon the general health.

A little blood is passed, mostly after the urine; there is little frequency of micturition, though perhaps a difficulty in retaining the water when the call has come. In one instance the prostate appeared to be solely affected, since there were no properly vesical or renal symptoms.

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[1] Sonsino, *Lancet*, May 27, 1882 p. 553

Mucous casts were passed, imbedding the eggs, while small quantities of venous blood, mixed with urine, were from time to time passed by the urethra, the rest of the secretion being unaffected, save that it was cloudy with mucus.[1] Such symptoms appear to be seldom attended with danger to life; the only fatal case referred to by Dr. Harley is that of a Scotchman, who died 'worn out by the various concomitants of the disorder' at the age of seventy-six. Among the concomitants must be mentioned the passage of renal calculi, in two instances of which Dr. Harley found the eggs of the parasite in the interior of the stone; constituting, as we can scarcely doubt, the point of primary deposit. This observation is of interest as placing beyond doubt the participation of the kidneys in the disease.

The calculi appear to be chiefly composed of oxalate of lime, though uric acid, which is a frequent deposit in such cases, takes part.

The urine itself was not, in Dr. Harley's cases, usually changed in quantity, or specific gravity, or in quality, save by the addition of the parasitic products, with blood, and its proper amount of albumen. It was not ammoniacal nor alkaline, but, on the contrary, apt to deposit uric acid. None of the ordinary products of cystitis were usually present, though sometimes there was a little blood-stained stringy mucus. In a case presumably of prostatic location the blood was passed only after breakfast or defæcation.

Subjects. The disorder in South Africa appears to attack foreigners and colonists in preference to the native population. Kaffirs are exempt, while coolies suffer. The disease seems to be nearly, but not absolutely, limited to males. When females suffer, it is said often to disappear with the advent of the menses, almost always to cease on the occurrence of pregnancy.[2] It was not transmitted to a wife whose husband had passed numbers of eggs every day of married life. Three or four healthy children had been born to the pair. Boys after the age of three or four are most liable, the complaint often disappearing about puberty. It has, however, been known to have been acquired at the age of fifty, and to have proved fatal at seventy-six.

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[1] Dr. John Harley, *Med.-Chir. Trans.* vol. liv. p. 48.

[2] Dr. Allen, *Lancet*, July, 15, 1882.

Hæmaturia of Mauritius.

The endemic hæmaturia of the Isle of France has long been known, but has not yet been definitely traced to the Bilharzia; there can, however, be little doubt that it is produced by this or some closely similar parasite. The symptoms and incidence of the disease are almost exactly those described at the Cape. Repeated attacks of hæmaturia occur with frequency of micturition and other signs of vesical irritation. The blood is in but small amount, not so much as to discolour the whole bulk of the urine, but only its last portion, after the discharge of which a few drops of blood may escape unmixed. Small clots are occasionally seen. Under the microscope have been found oxalate of lime, blood, mucus, and pus, with scales of bladder-epithelium. Probably before long this list will include the parasite.[1]

The disorder is here, as elsewhere, often associated with attacks of renal colic. It is said that three-fourths of the children in the island suffer from it, both sexes being affected, but boys apparently with the more frequency, since of these it is said that few escape. The disorder, as elsewhere, often disappears about the time of puberty. It has been attributed to masturbation and the use of spiced dishes—causes which, were they effective in this respect, might be expected to give rise to the disease in many other places—and with some probability to the quality of the water drunk. A form of hæmaturia presumably of the same origin has been stated to occur in Madagascar.[2]

It is of importance to inquire with regard to the creature a portion only of whose existence is passed within

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[1] Todd, *Clinical Lectures on Diseases of the Urinary Organs.*

[2] *On the Endemic Hæmaturia of Hot Climates*, by Dr. Guillemard, p. 36.

Source and mode of introduction of Bilharzia.

the human body, whence it may be derived and how admitted. As it is not known save as a human parasite, its derivation must be a matter of conjecture, but water is to be suspected as the means of its distribution. The Nile is thought to be the vehicle of the parasite in Egypt, and it has been suggested that some of the fish of that teeming river may furnish its temporary abode. Dr. Cobbold thinks it more likely that the larval form infests some gasteropod mollusc local to the district where the disorder occurs. At Uitenhage and Port Elizabeth, at the other extremity of the continent, the disorder is likewise attributed to water which is supplied by exposed streamlets in which water-plants abound. It is stated that in South Africa those only are liable [1] who drink river water or the water from marshes or pools, those who use well or rain water being exempt. Dr. Harley has shown reason to suspect water-cresses as conveying the parasite, whether themselves affording attachment to it, or, as he suggests, by means of minute mollusca in which the parasite is lodged adhering to the plant. It has been suggested that the ova find admission into the body during bathing, and that the frequency with which boys are affected as compared with girls is due to their more often doing so. The urethra has been regarded as the point of entrance, and it has been stated that in South Africa the natives are in the habit of tying grass round the orifice before wading or swimming across a river. On the other hand, it has been remarked that in South Africa the Kaffirs, who bathe often, are exempt from the disease, while the coolies, who bathe seldom, are often affected. Whether the parasite is admitted by the urethra or by the mouth must be regarded as at present uncertain; what we know of the habits of other similar creatures and the abundance with which these are found in the portal vein, where indeed they were first detected, would lead us to attach the greatest probability to entrance by the mouth; entrance by the urethra is supported by the concentration of the disorder upon the urinary organs and the blood-vessels in immediate connection with them. It has been suggested that the ova may be deposited in the skin and thus enter the superficial veins; but if thus introduced they should be conveyed to the systemic, not the portal vessels. Dr. Harley tells us that persons bathing in the Booker river, about which the disease is common, are sometimes attacked in consequence with an urticarious eruption, and that the colonists of Natal are constantly affected, when first resident, with indolent sores, especially upon the legs, which resemble syphilitic ulcers.[1] It is stated, however, by Dr. Guillemard, that the 'Natal sores' are distinctly and solely caused by the bite and subcutaneous burrowing of a species of tick which is quite unconnected with the Bilharzia; and though bathing must be admitted as with possibility affording means for the introduction of the animal, the evidence is against cutaneous entrance.

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[1] Dr. J. Harley, *Med.-Chir. Trans.* vol. liv. p. 60.

Treatment and prevention.

The Bilharzia appear sometimes to die out like a dynasty, so that the disease comes to an end spontaneously; this occurs especially about the time of puberty. As to treatment, since the habitation of the parent worms is in the blood, they are practically out of the reach of vermicides; this organised fluid could not be supposed to tolerate any admixture which would be destructive to animal organisms within it. All we can do, therefore, when the disease is established is to support the patient against it and use such local measures as may be effective against its more accessible manifestations. The latter endeavour resolves itself into the destruction by some suitable injection of as much of the parasite or its progeny as is lodged in the coats of the bladder. Whatever may be effected with regard to the unhatched eggs, it would not appear that any trouble is needed to destroy the ciliated embryo, since urine itself is fatal to it. With regard to the worms, most of them are obviously out of reach; those only which have penetrated the vesical wall are thus assailable; and even here not too readily, for the guest is protected by the sensibility of the host. The more active disinfectants or parasiticides could scarcely fail to injure the bladder. Experimenting with non-irritant solutions, Dr. Harley got the best results from iodide of potassium in a strength of five grains to the ounce. This gave rise to no vesical irritation and was followed by the expulsion of various parasitic products. Dr. Harley made trial of other remedies, including oil of male fern, wormwood, and quassia, with less satisfactory results. It is obvious that there is room for further experiment: quinine, the sulphides, and permanganate of potash might be suggested. Dr. Allen, of Pietermaritzburg, employed a concentrated solution of santonine in absolute alcohol, and injected this in quantities of two drachms into the empty bladder, with the constant result of cystitis, as might have been anticipated, but with the effect as he thought of destroying the parasite. It is indeed possible that the ova, like the bladder itself, may have been seriously injured by this application and the disorder locally suspended; but such relief is scarcely worth the cost if the parasite remain intact in the deeper veins. Dr. Allen[1] supposed also that by the administration of santonine by the mouth the creature would be killed in the blood-vessels, a presumption from which local treatment might be inferred to be unnecessary. The destruction of the worm in the blood-vessels by medicine conveyed by the blood cannot as yet be regarded as proven or as possible. Dr. Cobbold disapproves of injection, and directs his attempts to the arrest of the hæmorrhage rather than to the destruction of the parasite. He thinks the catheter should be avoided as injurious, and parasiticides as useless. Nothing, in his view, should be done to disturb the plugs which spontaneously form at the points of ulceration. He has found good results from the administration by the mouth of buchu and bear-berry.

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[1] The ova of the Bilharzia, which were found, as supposed, in Delhi boils, have been shown to be altered hair-bulbs.

With regard to prevention, if the parasite is, as there is reason to believe, brought by water and admitted by the mouth, it is obvious that spring or rain water should be drunk when possible, to the exclusion of that from streams and pools. But with the latter, infection should be completely intercepted by boiling or effectual filtration. Fish and vegetables from suspected water should be wholly avoided, or at least never used as food until after having been raised in cooking to boiling point. In view of modes of entrance other than by the alimentary canal, there should be no bathing but in the sea.

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[1] *Lancet*, July 15, 1882; also April 14, 1883.

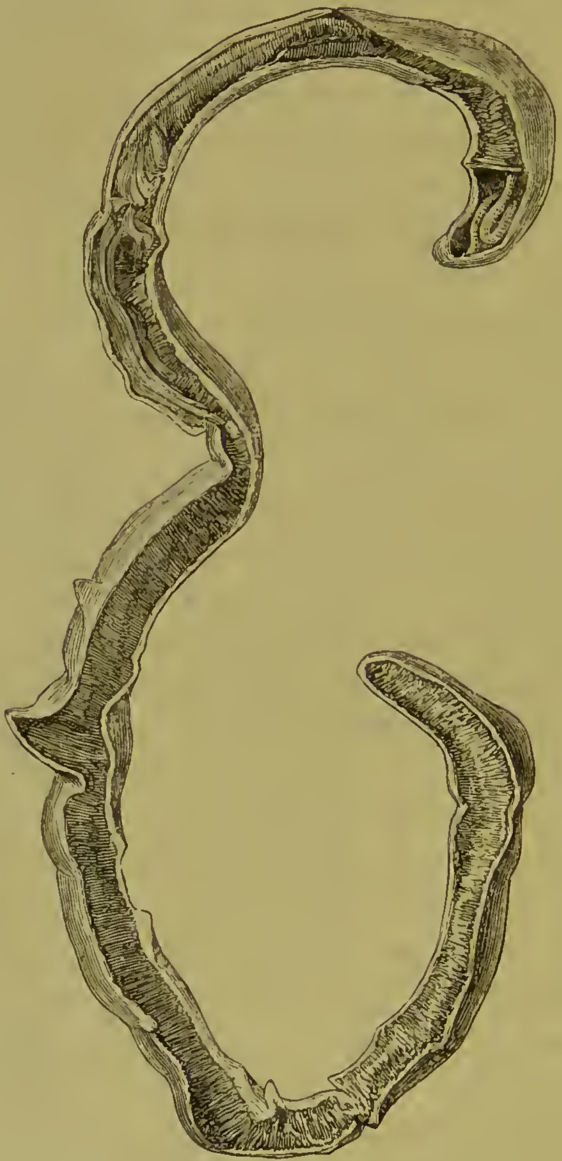
THE STRONGULUS GIGAS.

Description and site.

The worm which has been thus called, or otherwise the *Eustrongylus gigas*, both names alike bearing witness to its rotundity and to its size, is not only the largest individual parasite which takes residence within the human body, but is the largest nematode known. It may nearly be compared in its dimensions to one of the snakes common in this country, the male to the adder, the female to the common field snake. With the thickness of about half an inch the male attains the length of about a foot, the female of over three feet. The serpentine proportions of the creature are testified to by the older writers, who, when they found these parasites in the kidneys of wolves and dogs, described them as serpents in this situation.

This variety of strongulus, though not peculiar to the kidney, is most often found in this organ, of which it becomes the denizen in a large number of animals. It is said to occur with especial frequency in the weasel and the North American mink, destroying the substance of the kidney and giving rise to calcareous deposit in its walls. Among the animals in which this worm has been found Cobbold mentions the dog, wolf, puma, glutton, racoon, coati, otter, seal, ox, and horse.

The general appearance and something of the anatomy of the animal may be gathered from the accompanying woodcut, which represents the specimen which, on Cobbold's authority, we may accept as undoubtedly from the human body, which is preserved at the College of Surgeons. The adult worm, to follow Cobbold's description, is cylindrical, more or less red in colour, and somewhat



Strongulus gigas in the College of Surgeons, 'found in the kidney of a patient of the late Thomas Sheldon, Esq.' The wood-cut is of one-half the actual dimensions. The animal, a female, 18 inches long, has been laid open to show the intestinal canal, spiral œsophagus, and reproductive organs.

thicker behind than in front. The head is broadly obtuse, the mouth being supplied with six small wart-like papillæ, whereas the lumbricus, which the strongulus somewhat resembles, has but three. Two of the papillæ correspond with the commencement of the two lateral lines of the body. There are six other longitudinal lines which traverse the body from end to end. The tail of the male shows a simple cup-shaped bursa, which partly conceals the simple spiculum. The tail of the female is blunt and pierced by the centrally placed anal opening. The vulva is situated near the head in the ventral line. The eggs are stout and oval, measuring $\frac{1}{300}''$ in length, $\frac{1}{550}''$ in breadth.

Probable source.

In the stages of existence through which this parasite passes before entering the human or mammalian body and assuming the form to which the term *gigas* is applicable, it appears that certain fish, as probably in the case of the Bilharzia, play the part of intermediary bearers. It has been inferred by Schneider, and the inference accepted by Leuckart and Cobbold, that the worm known as the *Filaria cystica*, which is found encysted beneath the peritoneal membrane of the *Galaxias scriba* and *Synbranchus laticaudatus*, is the sexually miniature and undeveloped strongulus. It is easy to imagine that the minute inhabitant of the fish may be transferred to the fish-eating animal, the otter, seal, and even the dog and the wolf, and man himself, but it is less easy to explain its transmission to the ox and the horse. Probably water is the vehicle.

Geographical distribution.

With regard to the geographical distribution of the strongulus, it appears to be less uncommon in the Low Countries than elsewhere both in man and animals. Of the eight cases referred to as probable, two were recorded in Holland. Of another, the subject was a Frenchman who had been to Walcheren. Two others occurred in France. Of the eighth, from which was obtained the specimen in the College of Surgeons (see woodcut), nothing further is known than that it was taken from the kidney of a patient of the late Thomas Sheldon, Esq.

The chosen position of this worm is the pelvis of the kidney, in which it lies in a coil or knot; but as it has been passed with the urine in the human subject, it is obviously not limited to any subdivision of the urinary cavity. In dogs, in which opportunities of observing the habits and effects of the parasite have been more frequent than with other animals, it has been found stretched along the whole length of the ureter, in the bladder, in the peritoneal cavity, into which it had passed from the renal pelvis, and in external swellings in the neighbourhood of the penis.

Local effects.

Davaine has gathered so many of the scattered instances in which this worm has secured its admission into the human body that it is to his research that we are chiefly indebted for our knowledge of its clinical results. From the year 1674 to his date of publication, 1877, this writer has collected seven cases which he regards as 'probable,' eight as 'very uncertain,' which may be taken to represent our whole recorded experience of this parasitic disorder in the human subject. Among the seven 'probable' cases were two in which the worms had been passed by the urethra only, one in which they had escaped by lumbar fistulæ and the urethra also, four in which they were found in the kidney after death. Of these four to which alone we can appeal for pathological information, there is but one in which the condition of the kidney is described with any minuteness: in this case the secreting structure was nearly destroyed, and the weight of the organ reduced to about half (see p. 1096). With animals the kidney has often been noticed in these circumstances to have displayed all the effects of pyelitis, to have become variously dilated, as happens from stone, and in the North American mink in particular to have become converted into a cyst, the walls of which are the seat of calcareous deposit. An instance has already been referred to in the dog, in which worms of this nature had passed from the renal into the abdominal cavity.

The instance[1] relating to the human subject in which stronguli were discharged through a lumbar abscess may be further mentioned, notwithstanding that it has been quoted by other writers. A boy was cut for stone by M. Moublet at the hospital of Tarascon, and a large calculus removed. Four years later, after an attack of partial suppression of urine with much constitutional disturbance, an abscess was found in the lumbar region, was opened, and healed. But the cicatrix after a time was undermined by renewed suppuration and again opened. From the opening thus made a living strongulus was withdrawn by the child's mother, and a few hours afterwards another by M. Moublet. Two days afterwards two worms of the same kind were passed by the urethra, one with the help of forceps, the second spontaneously. Having thus got rid of four of these formidable interlopers the child recovered.

If we may accept a case, which, however, Davaine has shown to want corroboration, the concurrence of a stone with this parasite which M. Moublet's patient presented is not singular. A worm apparently of this nature was, as far back as the year 1595, found in the kidney of a Belgian archduke, together with a calculus. Given the worm, the stone is not improbable as a result; some of the exuviæ might readily give ground for concretion.[2]

General symptoms.

The symptoms produced by the presence of this parasite in the kidney are those of stone aggravated in respect that rest brings no relief, and with the repulsive addition, if we may accept the evidence of a single instance, of a sense of movement in the renal region. The symptoms are graphically displayed in a case related by M. Aubinais[3] and quoted by Davaine. A French husbandman, sixty years of age, was seized with sharp pains in the region of the right kidney, which were supposed to be nephritic. For three years then, in spite of many anodyne and other remedies, these were incessant and most severe, and the man, formerly somewhat obese, was reduced to a skeleton. In this condition of attenuation, movements of swelling and undulation, apparently in the situation of the right kidney, could be felt and seen through the thin abdominal wall. The patient himself was conscious of crawling movements, or movements of 'reptation,' as M. Aubinais terms them, in the same position. After three years of these sufferings bed-sores formed, and death was brought about by wasting and exhaustion. The right kidney was removed twenty hours after death by an incision through the flank. Undulatory movements were still perceptible within it, and a living strongulus over seventeen inches long and nearly a quarter of an inch in thickness (from five to six millimetres) discovered in the pelvis. The tissue of the kidney was much altered, its parenchyma in great part destroyed, and its weight reduced by half.

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[1] Moublet, *Journ. de Méd. et de Chirurg.*, Juillet 1758. Quoted by Rayer, Davaine, Chopart, &c.

[2] D. M. Jansonius, *Mercurii Bello-Gallici*, tome ii., cité par Schenck.—Davaine, *op. cit.*, p. 285.

[3] Quoted by Davaine, 2nd edition, p. 285.

It is scarcely needful to dwell further on the symptoms: severe attacks of hæmaturia have in some instances marked the presence of the worm, but this symptom has not been noticed in all. Temporary suppression of urine has occurred apparently in consequence of its entering the ureter; in such a case the other ureter must have been also obstructed, possibly by other means. The distinction from stone or growth must be seldom practicable until either worms themselves or their eggs have been passed. The passage of the latter with the urine, should the domestic relations of the parasite be consistent with their production, ought, considering their conspicuity as microscopic objects, to furnish ready means of detection. As to Treatment. treatment, it may fairly be inferred that parasiticides are useless. If in the bladder or urethra its removal will be indicated; the means must be suggested by the case itself. If in the kidney, it may be considered whether the circumstances are such as to justify nephrotomy.

PENTASTOMA DENTICULATUM.

Description, habits, and usual situation.

This creature, which would be comprehended under the common term *tick*, must apparently be counted as a renal parasite, though it has no clinical significance in this relation. Like many other parasites, it presents two different phases, which have become known by different names. In the adult state, as the Pentastoma tenioides, it lives at large in the nasal cavities, chiefly of the dog, where it presents the shape of a maggot or wingless insect, covered with rings of mail, varying according to sex from one to three inches in length, the male being the shorter. In the larval state, as the Pentastoma denticulatum, it attains the length only of about an eighth of an inch, and is narrowly confined within a cyst which is embedded usually in one of the abdominal organs. The animal in this stage of its existence, in which only its interests are concerned with those of the kidney, is somewhat ship-shaped or navicular, with a rounded forepart, where are placed four hooklets or anchors, with lines narrowing towards the stern and sides beset with fine spines.

The relationship between the large and active adult and the minute and imprisoned offspring appears to have been fairly ascertained. The ova of the nasal intruder, carried out with mucus or expelled by sneezing, may readily attach themselves to the food of men or of animals; thus taken into the stomach, the embryos escape and bore, for which purpose nature with an impartial consideration of their necessities has provided them with a suitable apparatus; they thus enter various organs and tissues, among which the liver appears most often to supply their resting-place, but occasionally the lung, the submucous tissue of the small bowel, and the kidney. The kidney, so far as I know, has been mentioned but once in this relation, and that by Wagner; but our knowledge of the distribution of this parasite in its larval stage makes it more than probable that this localisation of it is not solitary, though otherwise unnoticed. The imbedded larvæ, or those of them which are destined for further development, are released when the flesh in which they lie is torn up by the dog or wolf, and thus liberated sniffed into or otherwise enabled to enter the inquiring nose of the quadruped. From this the completed cycle begins again.

The embryo having reached its place of rest repeatedly casts its skin with rapid growth, and at last attains the perfected larval form to which the name Pentastoma denticulatum has been given, which remains encysted and inactive in the organ in which it has been imbedded until it is introduced to the upper world by some such process as has been referred to. Unlike the Pentastoma constrictum, the presence of which has been associated with destructive inflammation, no symptoms have been traced to the denticulatum. It appears to be by no means uncommon in some parts of the Continent, however rare in this country. According to Frerichs, it is to be found in the liver more often than the echinococcus; though Murchison in England long sought for it without success. It appears to be especially common in Brazil.[1]

Instance its occurrence in kidney.

In the only instance in which the parasite was recognised in the kidney a small whitish slightly raised oval patch of fibrous appearance, about one-seventh of an inch in length, was found underneath the capsule. This little body was hollow in the interior; it contained a yellowish mass, which on examination disclosed the presence of the worm.[2]

TETRASTOMA RENALE.

The so-called Tetrastoma renale may be briefly dismissed as of uncertain origin, though probably parasitic.

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[1] See Cobbold's *Parasites*, 1879, p. 259. Davaine, *Traité des Entozoaires*, 1877, p. cxxiv.

[2] Wagner's description quoted by Roberts, *Renal and Urinary Diseases*. 2nd edition, p. 591.

A parasite to which this name was given was found by Lucarelli in the urine of an old woman who was thought to have symptoms of stone, and it was inferred that it had come from the kidney tubes. On the death of the patient, however, two months afterwards, no such parasites were to be found there or elsewhere.[1] This trematode was described by Delle Chiagè as having a length of five lines, an oval flattened body, and four suckers at the caudal extremity.

Worms accidentally present in the Urinary Passages.

Thread worms.

Worms belonging to the alimentary cavities may accidentally enter the urinary. Oxyurides, or thread worms, may crawl from the rectum and reach the vulva, or the orifice of the female urethra, into which channel they may possibly intrude themselves to be passed with the urine.

Round worms.

Other bowel worms, should they be found in the urinary cavities, must have come through a fistulous communication. This has most often been the case with regard to lumbrici, animals which have a remarkable propensity for penetrating into small holes of every kind. These worms have often thus fatally entrapped themselves in buttons and 'hooks and eyes,' which have been accidentally swallowed, and others have penetrated into abscesses and other cavities opening upon the alimentary canal. With regard to the bladder, a large number of instances are on record in which these worms have got into it through fistulous openings and been passed with the urine, and we are indebted to Davaine[2] for bringing them together.

Several of these worms have at intervals been expelled or withdrawn from the same urethra. A boy seven years of age, after having had retention of urine for seven days, perceived the extremity of a worm protruding from the meatus, pulled it out and was relieved. A year later another lumbricus presented itself, and was removed by the boy's mother. During the two years succeeding the second removal, many worms of the same sort were similarly got rid of. Subsequently, many similar worms escaped by the anus, violent pains occurred in the region of the bladder, purulent urine was discharged with the stools, and the patient sunk. It was found that the vermiform appendix was displaced, and was adherent to the bladder, with the interior of which that of the vermiform appendix communicated by a fistulous opening. A large calculus was found in the bladder, and in the calculus a pin. This had probably been the origin of the whole complication; it had been swallowed, had entered the appendix, and thus set up inflammation, which had led to adhesion and then to ulceration, by which it had reached the bladder and become the nucleus of the stone.

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[1] *Entozoa*, by Cobbold, 1864, p. 204.

[2] *Loc. cit.*, p. 300.

The symptoms, after the early retention of urine, were apparently due more to the stone than to the worms; indeed, where lumbrici have reached the bladder from the bowel, unless they have entered the urethra and caused retention, the symptoms appear to be little more than those which commonly attend the fistulous communication.

Another case is recorded nearly parallel to that mentioned, in which lumbrici, passed from the bladder, were found to have reached it through an adherent and perforated vermiform appendix. In this case also a stone was found in the bladder. Instances are likewise on record in which a similar intrusion has occurred by way of a fistula between the bladder and rectum.[1]

Joints of tæniæ have been known, though rarely, to have been similarly introduced into the bladder.

Spurious Worms.

An endless variety of insects, worms, and vermiform bodies have been introduced into the urine by accident or design, and placed upon record as urinary parasites, while some have been not parasitic, and others neither parasitic nor urinary. Some supposed worms have clearly been vermiform coagula from the ureter. Of other supposititious parasites, the extraordinary research of Davaine has provided a large selection collected from ancient and modern literature. These would appear to include all possible and some impossible insects. These are variously described as winged, provided with legs, antennæ, or eyes of fire, while others present the form of scorpions or the more familiar shapes of beetles and grasshoppers.

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[1] W. Kingdon, *London Med.-Chir. Review*, July 1842.

Though such obvious mistakes are little likely to be now repeated, nevertheless modern days, as if the art of deceiving improved *pari passu* with the means of detection, have witnessed such successful imitations of urinary parasites as to pass current with observers of approved skill and technical accomplishment.

Dactylius aculeatus.

A girl five years of age was supposed to have passed with the urine a number of worms of from four-fifths to two-fifths of an inch in length. These were carefully examined by Mr. Curling, and described by him in a paper read before the Medico-Chirurgical Society as a new urinary parasite under the name *Dactylius aculeatus*. For a time the discovery appears to have remained unquestioned, but there appears to be little reason to doubt from the observations of Cobbold and others that the worm was but a species of earth-worm known to frequent flower-pots, and described under the name *Euchytrœus albidus*. The mode of migration, as Cobbold observes, from the flower-pot to the receptacle in which the supposed parasite was found is not difficult of explanation.

Spiroptera hominis and Diplosoma crenatum.

Two other spurious urinary parasites, which were furnished by the same patient, and have been dignified by the names *Spiroptera hominis* and *Diplosoma crenatum*, need a passing mention, as connected with one of the most remarkable of those female simulations which are so incomprehensible to the masculine mind. The primary victim and sponsor of the imposture was, together with Mr. Barnett, the acute and sceptical Lawrence, who brought the case as one of parasitic disease before the Medico-Chirurgical Society. A young woman had obstinate retention of urine with symptoms such as commonly indicate stone in the bladder. The catheter was used as frequently as such a patient could desire. She was sounded for stone in vain, but described a 'fluttering' in the bladder, presently succeeded by the withdrawal of several small worms which had become curiously entangled in the eye of a catheter retained for a time in the urethra. Worms, or what passed for them, were evacuated actually or ostensibly to the number of above 800. These were of two kinds: small veritable worms, which were described as *Spiroptera hominis*, and larger vermiform bodies, which Dr.

Arthur Farre, after elaborate examination, entitled *Diplosoma crenata.* Specimens of both were forwarded to Continental museums; the discovery was for a time accepted, and two parasites were added to the list of these concealed enemies of mankind. The small worm, however, truly parasitic though it was, proved to belong not to the human being but the fish; it was identified beyond doubt by Dr. Schneider as the *Filaria piscium*, a worm of common occurrence in the haddock and cod; while the *Diplosoma crenata*, as Cobbold has shown, almost certainly consists of slices of haddock's roe. The smaller worms, from half an inch to an inch in length, sometimes made their appearance alive, and lived in the urine for three days. The report is explicit as to the circumstance that most or many of these were actually discharged through or withdrawn with a catheter, so that it is certain that some at least actually came from inside the bladder. The patient, therefore, must have introduced not only sham worms, but loathsome living parasites, within the penetralia of her own body. The satisfaction she derived from so doing must have been considerable if it bore any proportion to the sufferings entailed: these comprised the utmost distress from strangury, typhoid prostration, and a large abscess which burst into the vagina after constitutional disturbance which well-nigh proved fatal.[1]

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[1] See 'Case of a Woman who Voided a large number of Worms by the Urethra,' by W. Lawrence, *Med.-Chir. Trans.*, vol. ii. p. 382. Dr. Arthur Farre, *Archives of Medicine*, vol. i. p. 290. Also Dr. Farre's article 'Worms,' *Library of Medicine*, vol. v. p. 241. Dr. Beale, *Kidney Diseases*, &c., 3rd edition, p. 399. Cobbold, *Entozoa*, pp. 406, 409.

CHAPTER XIX.

CHYLURIA.

HISTORY AND CLINICAL ASPECT.

Designations; early views.

THE disorder which is known by this name, and characterised by the passing of urine, which has been regarded as chylo-serous, chylous, or hæmatochylous, or more barely described as oleo-albuminous or albuminous and fatty, is one which both in its cause and in its symptoms presents itself with remarkable isolation and distinctness. The leading symptom is the admixture with the urine of a fatty emulsion which has all the properties of chyle; while its most common if not its only cause is the presence in the living body of parasitic worms, of which the adults appear to be located in the absorbents, while the progeny find their habitation in the blood-vessels, and their element in the blood.

The disorder is one which has long excited curiosity; and, indeed, it seems to have received its name almost prophetically at a time when, neither chemically nor by the microscope, could the chylous admixture be ascertained. John Peter Frank, in his fifth book, *De Profluviis*, which represents the state of knowledge in the year 1794, speaks of *diabetes chylosus*, or *fluxus per renes cœliacus*. It is needless to interpolate that, in the language of the older writers, a cœliac flux was an escape of what they thought to be chyle. Further than this, Frank uses the actual term chyluria, and distinguishes between this condition and one of purulent admixture; though it is not impossible, and is indeed suggested by his description, that urine which was thus regarded as chylous may have been merely phosphatic. He attributes it especially to persons, otherwise in good health, who take active exercise after a full meal; a familiar cause of phosphatic urine, and, it may be added, no less an incentive to a chylous state of that secretion in a chylurious subject.

Cruickshank,[1] also, in the year 1806, speaks of urine of a white colour, as was supposed from chyle; but since he attributes this to children who are subject to worms, it is probable that he also refers merely to urine milky with phosphates. Thus chyle, although conjecturally spoken of as passed with the urine, does not appear to have been conclusively recognised in that relation until the time of

Prout and Bence Jones.

Prout,[2] who, in the year 1821, described some urine as so closely resembling chyle in all respects that, had it been brought before him as a specimen of that fluid, he might not have discovered the imposition. This observer, however, though he gives a clinically excellent sketch of the disease, scarcely attained to an adequate idea of its nature. He saw in it only an arrest of assimilation, and the discharge by the kidneys of chyle which had failed to undergo its proper transformation into blood. In describing the urine as chylo-serous rather than chylous, he pointed to its supposed analogy with the disorder characterised by serous urine, of which he held this to be a mere variety. Dr. Bence Jones[3] thought, with Prout, that the chylous discharge was derived from the blood, but attributed it, not to defective assimilation, but to some slight alteration in the structure of the kidney, which allowed the constituents of chyle to transude from the blood-vessels, and which remained without repair for years. He thought the leak could be closed by means of gallic acid, and detailed a case with much minuteness which afforded this inference. The cure, however, was only temporary, and the habit of the complaint to intermit for long periods, independently of treatment, must make us cautious in dealing with the effects of remedies.

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[1] *Experiments on Urine and Sugar.* Appended to Rollo's work on *Diabetes*, p. 451.

[2] *An Inquiry into the Nature and Treatment of Gravel, &c.* Edit. i. p. 41.

[3] *Lectures on Pathology and Therapeutics.* 1868. P. 256.

The views held by Prout and Bence Jones were not very different from those expressed at a later date by Dr. Waters,[1] who believed that 'the main pathological feature of the complaint was a relaxed condition of the capillaries of the kidneys,' which allowed fibrine fat and corpuscles to filter from the blood-vessels into the urine, the leading idea up to this time being that the addition to the urine was supplied by the blood; a view which, besides other objections, is inconsistent with the fact, which frequent observations have placed beyond doubt, that though the urine be milky the blood is not; the peculiarly subdivided fat which is a characteristic of chyle and of chylous urine being uniformly absent from the blood.

Perhaps it may be fairly said that until quite recently, though many examples have been placed upon record and the clinical characters of the disease well illustrated, yet no clear light has been thrown upon its pathology further than was apparent to Prout.

Gubler.

The important suggestion that the urinary change was produced by a direct discharge of the contents of the absorbents into the urine was made by M. Gubler,[2] and the derangement attributed to a varicose state of the renal lymphatics, analogous to that which on the surface of the body had been known, especially within the tropics, to be attended with a lymphatic discharge. Later this view presented itself to Dr. Vandyke Carter, of Bombay, who, in an admirable paper read before the Medico-Chirurgical Society, went far to prove the change to be due to the direct discharge of chyle into the urinary system. He attributed this to some morbid communication between the lacteals and lymphatics of the lumbar region with the pelvis of the kidney, ureter, or bladder.

V. Carter.

Lewis.

Lastly, Dr. Lewis, of Bengal, made the striking discovery which associates the mechanical derangement with the presence in the blood, in the kidneys, and elsewhere, of verminiform parasites; a discovery to which important additions have been made by other observers.

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[1] *Med.-Chir. Trans.*, vol. xlv. p. 221 (1862).

[2] *Gazette Médicale de Paris*, 1858, p. 646.

Definition and general description.

Without further preface I will proceed, with the aid of a series of cases collected from different sources, including several under my own care, to sketch the more prominent features of the disease as in the present day it presents itself to our view. The definition lies in the state of the urine, and is implied in the name. Though the chylous admixture appears to be commonly associated with a tropical parasite, and the disorder correspondingly frequent in such regions, yet it is clear that beside the endemic we have what may be termed an accidental form of the disease, which occurs in persons who have never left our own country; either because the parasite may be engendered as well in temperate as in tropical places, or because the necessary communication between the channels of chyle and those of urine may be made otherwise than by its agency.

Geographical distribution.

To touch first upon the geographical distribution of the disease, I find that among 72 cases (67 placed on record by various writers to whom reference has mostly been made in the course of this chapter, and 5 within my own knowledge) there are 5 in which the disease was unequivocally of English origin; 59 in which it had originated in tropical or subtropical regions, using the last expression somewhat liberally, so as to include that large proportion of the earth's surface which lies between 40° of north latitude and 40° of south latitude; from the south of Europe, that is, to the south of Australia; and 8 in which the place of origin was uncertain, among which is classed one to be presently related, of which the subject had lived in India, but had been in England for five years when the symptoms appeared.

First, as to the cases of European beginning. One, under my own observation, was in the person of a man who was born in Suffolk, had lived almost all his life in London, and never left England. Dr. Beale relates a case, which was witnessed by Mr. Cubitt, of which the subject, a woman aged 50, was a 'native of Norfolk, in which county she had always resided.' Another case, from the same county, that of an agricultural labourer, 57 years of age, is reported by Dr. Dale in the 'Lancet' for July 23, 1877. The man was a patient in the Norfolk and Lynn Hospital, and had never left Great Britain. It is of interest to observe in passing that this patient was the subject of a fluctuating swelling on the left of the spine, which was thought to be a chronic abscess, but disappeared. The fourth instance, that of a woman who was born in the neighbourhood of Manchester, and had never lived out of the country, is related by Dr. Roberts. The changed appearance of the urine in this case was first observed after delivery—not the only case in which a relation has been apparent between chyluria and gestation. Another instance, not, however, of persistent chyluria, is mentioned by the same author, in which a transiently chylous condition of the urine, associated with a chylous discharge from the surface of the abdomen, was noticed in a man 'always a resident in Lancashire.' Another indigenous case is recorded at p. 1144; the young woman who was the subject of it was born in a suburb of London, and had never left England, or indeed been far from home. These instances, a minority though they be, are enough to show that the disorder is not necessarily of tropical or subtropical origin. But how often it is one or the other is shown by the fact that among sixty-five instances in which the place of origin was known, sixty pertained to persons who had been born in or had visited the latitudes between that of South Australia and that of Gibraltar, and had probably contracted the disease within these limits! We have evidence of its origin in many parts of India; it is well known in each of the three Presidencies; in China; in the West Indies, with especial mention of Barbadoes, Trinidad, and Demerara; in Cuba, Bermuda, Brazil, frequently in Mauritius, in the Isle of Bourbon, and further south, so as

Subjects.

to include the southern parts of Australia. We have, indeed, received important information from Brisbane, where the disorder is well known. It appears to prevail especially in insular and maritime districts, and with this preference to include within its range portions of each of the four quarters of the globe and of Australia. It may be doubted whether any parasitic or endemic disease is equally widely scattered. For our extensive knowledge of it we are indebted to the extent of our empire and the wandering propensities of our race. Within its chosen localities it attacks, without exemption, natives, persons of European birth, Jews, and negroes. As to sex, of the seventy-two cases mentioned the subjects were of the male sex in forty-one, of the female in thirty-one, instances. The preponderance of males in our records may be due to the more numerous exposures of men, among Europeans, as the more frequent travellers, to the endemic influence which causes the disease, while perhaps among Orientals women may be less accessible to medical observation than are men. Dr. Lewis, indeed, tells us that at Calcutta the patients suffering from chyluria have for the most part been women; but, on the other hand, it is to be noted that the larger number of instances he has recorded were of the male sex, while of the cases referred to by Dr. Vandyke Carter, whose field of observation was Bombay, all were males. The disorder is probably divided with much impartiality as regards sex.

With regard to age no period of life appears to be exempt from its attacks. Prout mentions an instance at the age of eighteen months. I was consulted touching the son of an Indian surgeon, who was attacked with the disease before completing his fifth year. A case is known to have proved fatal at the age of twelve. After this period the frequency of the disorder appears to increase; it is common in adolescence and middle age, and not unknown in advanced life. Rayer refers to the case of an old woman, a native of the Isle of Bourbon, who had the disease,

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[1] Quoted from Quevenne. Rayer, *Maladies des Reins*. vol. iii. p. 427.

with one short intermission, from the age of twenty-five to that of seventy-eight, when it was still unconcluded.

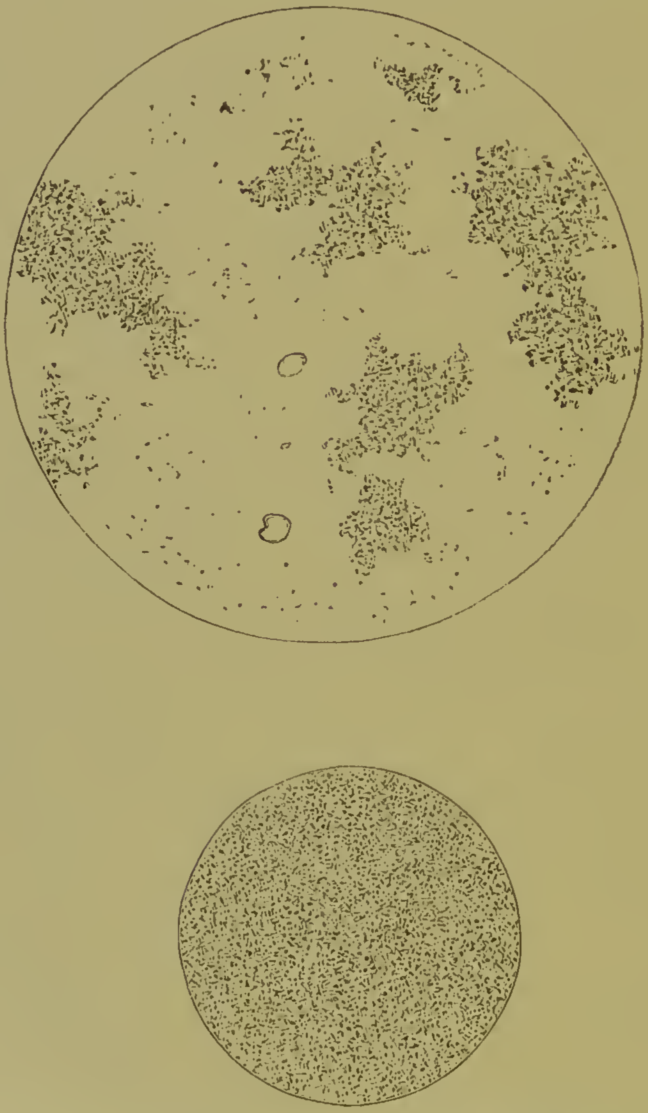
General symptoms.

The course of the disorder, and its symptoms so far as there are any, may be broadly sketched. Putting aside the condition of the urine, it may be said that of special or distinguishing symptoms there are none. It is remarkable even that the urinary organs themselves seldom show any signs of disturbance. There is sometimes pain in the back of a somewhat indefinite kind, but there are no dropsical, uræmic, or any other constitutional signs of renal disorder, and what perhaps is more surprising, there is no frequency of micturition or evidence of vesical irritation. Such symptoms as are produced are those of inanition; in the case of Eugenia P—— (p. 1144) wasting, pallor, loss of strength, and depression of spirits were marked so long as the discharge was unchecked, at once mitigated with its control. The catamenia were irregular; the temperature of a somewhat low average. The constitutional results of the disorder appear to be produced solely by the waste of nutritive material. Some persons bear the loss better than others, and in several instances the general health seems to have been perfect; the patient has remained of robust aspect, and displayed no failure in strength; women thus affected have repeatedly borne children. As it happens when nutrition is impaired in other ways by waste or want, tuberculosis often supervenes, and indeed has been found in most of the cases where chyluria has ended fatally. Whether the tubercles are always strictly of this nature, or whether, as is possible, they may in some cases have been local results of the parasite with which the disease is connected, we have no evidence to show.

Urine.

In the condition of the urine lies the definition of the disease; and, indeed, so solely is its recognition dependent upon the state of this secretion, and so little may disturbances of any other sort obtrude themselves that, as Dr. Bence Jones observes, were a patient blind he might not know himself to be ill.

The urine becomes milky in appearance, so as to resemble rich and creamy milk. The milky admixture has no tendency to subside, but will remain apparently in uniform suspension for many days. This peculiarity is due to the presence of fat in a state of molecular or immeasurably fine subdivision. Occasionally oil globules have been detected as such, but this is rare. Usually the fat appears in a delicately granular shape as represented, and sometimes in so fine an emulsion that though the milkiness is evident enough, yet under the microscope nothing more can be discerned than an indefinite turbidity. The fat sometimes collects on the surface in the



Chylous urine showing molecular base. From case of Mrs. E——, related at page 1155. × 600 diameters.

shape of cream or creamy flakes. The amount of fat or of milkiness in chylous urine depends closely upon food, the urine of digestion containing this addition most abundantly, that of fasting containing less or even none at all.

Besides the fat, blood is a nearly constant constituent of chylous urine. This often gives a delicate pinkish tint to the fluid, though this tint is less deep than would be expected from the quantity of blood involved, the red colour being covered by the white opacity. On standing, however, the corpuscles fall as a bright bloody sediment.

It has been observed that whether wholly derived from blood or otherwise, the pinkish tint of the chylous clot deepens on exposure to air,[1] a circumstance which points the resemblance between the urinary admixture and the superficial discharge from absorbent glands, which has in some instances been associated with it. A more distinguishing peculiarity of chylous urine is its habit of spontaneous coagulation; shortly after expulsion it will, if rich in its characteristic addition, set into a tremulous jelly which has been likened to blanc-mange, and which will after a time break into a mixture of liquid and flaky coagula. The gelatinizing process sometimes takes place in the bladder, and the clots have often formed troublesome obstacles in the urethra.

Some observations upon chylous urine, which need not be recapitulated here, are given with cases under my own care, subsequently related.

Dr. Beale describes the urine passed in the morning by Mr. Cubitt's patient as having the appearance of fresh milk. It became clear on the addition of an equal volume of ether. The reaction was neutral, the specific gravity 1013. A second specimen of the same patient's urine, passed during the same day, which was not albuminous nor milky though slightly turbid, was also examined. It had a specific gravity of 1010, a reaction very slightly acid.

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[1] Dr. Vandyke Carter. *Med. Chir. Trans.* vol. xlv. p. 192.

Analysis of 1000 *parts of Chylous and of Non-chylous Urine passed by the same Patient on the same Day. By Dr. Beale.*

	Chylous		Non-chylous
Water	947·4		978·8
Solid matter	52·6		21·2
Urea	7·73		6·95
Albumen	13·00		—
Uric acid	—		·15
Extractive matter with uric acid	11·66		7·31
Fat insoluble in hot and cold alcohol but soluble in ether	9·20		
Fat insoluble in cold alcohol	2·70	13 9	·0
Fat soluble in cold alcohol	2·00		
Alkaline sulphates and chlorides	1·65		5·34
Alkaline phosphates	4·66		1·45
Earthy phosphates			·15

The milky urine contained no oil globules. The fatty matter was equally diffused throughout in a molecular form. By the highest powers of the microscope only very minute granules could be detected which exhibited molecular movements.[1]

In Dr. Beale's analysis the chylous urine differs from the non-chylous chiefly in the presence of albumen and fat, the larger proportion of phosphates and the smaller of sulphates and chlorides. Occasionally, as in a case published by Dr. Bence Jones,[2] the oil has been known to take a globular form, collecting on the surface in this shape, and leaving the bulk of the fluid clear. Even in this instance, however, as in others, the fat was usually finely divided and evenly diffused.

Corpuscles indistinguishable from those of chyle have also been found. Dr. V. Carter, in the case of a Hindoo who had also a chylous discharge from the scrotum, points to the resemblance between the superficial and the urinary discharge. Both coagulated on exposure, and assumed an increasingly pink colour. In the superficial discharge beside red corpuscles were bodies 'resembling the lymph corpuscles of blood.' In the urine, together with red corpuscles, were 'granular cells much larger than these, and showing, on the addition of acetic acid, three or four nuclei in their interior; they were in short chyle corpuscles.' I must also draw attention to large rolling cells of globular form and epithelial type, which resemble some which belong to the bladder so nearly, that it is at least probable that they have this origin. I have never had opportunities of watching a case of chylous urine without finding these cells repeatedly and abundantly, in men as well as in women. If they be vesical they afford a pathological indication of some importance. Next to the fat the most remarkable constituent of chylous urine is the fibrine, conferring as it does the power of spontaneous coagulation. In Dr. Bence Jones's case the urine could not be got out of the bottle until the coagulum had been broken up by agitation. A patient of mine who had passed chylous urine in India, described it as retaining for a time the shape of the vessel in which it had solidified, like jelly turned out of a mould; and the same phenomenon

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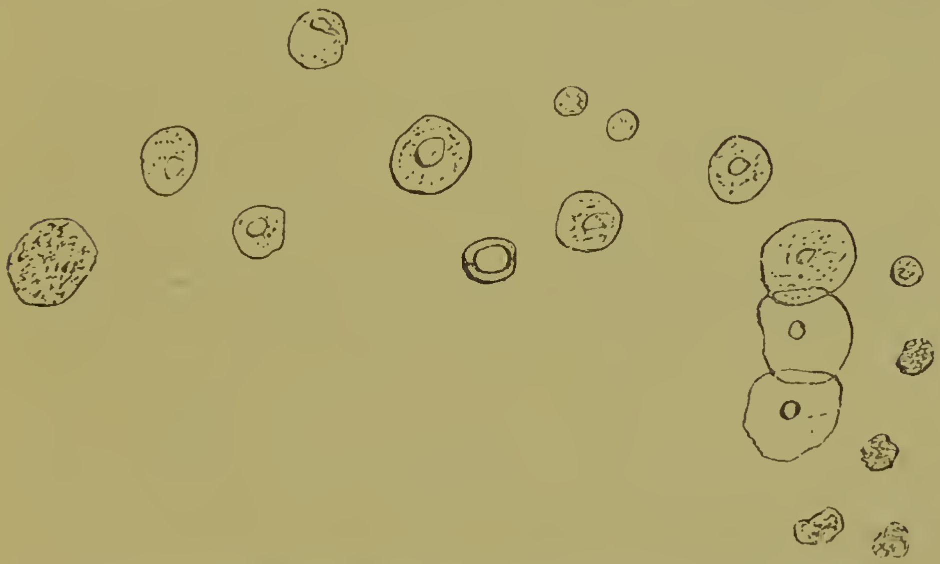
[1] Beale, *Kidney Diseases*, &c. Third edition. p. 301.

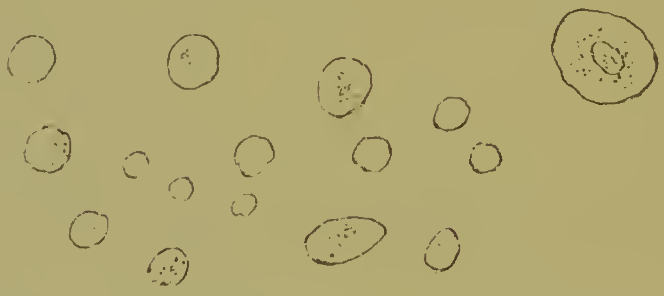
[2] *Med. Chir. Trans.*, vol. xxxiii. p. 314.



Large globular cells, probably vesical, from chylous urine, Eugenia P——, page 1144. × 350 diameters.

was observed in the case of Eugenia P—— (p. 1144), the urine falling out of its receptacle in a pink tremulous mass like a large jelly-fish. The coagulation sometimes takes place in the bladder with consequent difficulty in expulsion; clots sometimes stick in the urethra, or have to be drawn from its orifice. The fibrine, however, is not always present in chylous urine, or at least not in sufficient quantity to show itself by coagulation. The fibrine is most deficient where the molecular base is most abundant.

Large globular cells found in chylous urine. From case of Mrs. E——, related at page 1155. × 600 diameters.



Large globular cells from chylous urine. × 600 diameters. From case of a man 50 years of age, a native of Suffolk, who had never left England. The molecular base was very abundant.

The chyle in its passage from the bowel to the thoracic duct becomes, according to Dr. Vandyke Carter, increasing fibrinous in its course, and the varying amount of fibrine and fat in chylous urine he explains on the hypothesis that in different cases the chyle which enters the urine is withdrawn at different stages in the course of the absorbents.

The fibrinous constituent of chylous urine has never been found in the form of casts,[1] though these shapes have been sought by, I believe, every observer of late years who has written upon the subject. This alone is suggestive of a view which is corroborated by many other circumstances of the disease, that the chylous admixture reaches the urine otherwise than by the renal tubes. The faults of the urine appear to be essentially those of addition. Taking from it the constituents of chyle, the characters become those of health, or depart from them only to the extent of an impoverishment which leaves the urine still sufficient for the relief of the system. The disease is not productive of uræmia or any effect of renal deficiency. And that the urine must sometimes fall short in its essential ingredients is as evident as that the materials which should go to form them are discharged in other shapes.

In the case related at p. 1145, where the urea was estimated for twenty-four hours, its amount was found to be little more than 15 grammes, while in relation to the weight of the body the amount should have been about 22 grammes. In Dr. Bence Jones's case the urea amounted to 13·26 in 1000 parts; the salts to 8·01, a diminution in both particulars. Dr. Beale's observations, as already quoted, show the same change in a greater degree. Instances, however, have been published, one for example by Dr. Golding Bird,[2] in which no want of urea appeared. Uric acid crystals have been frequently noticed. They were abundant in one of the cases under my own observation.

Perhaps the most important inference to be drawn from the state of the urine in this disease is one for which we are chiefly indebted to Dr. Vandyke Carter. Rayer long ago demonstrated experimentally that when chyle and urine were mixed together a liquid closely resembling the chylous urine of disease was produced. He, however, does not seem to have inferred that the morbid process involved any such direct mingling. Dr. Carter showed how minutely chylous urine corresponds with a mixture of normal chyle and normal urine, and insists that the disorder is produced by a direct admixture of the contents of the absorbent with those of the urinary channels. Fibrine is absent from the early course of the lacteals, to be acquired in the mesentery; so chylous urine is sometimes coagulable and sometimes not, as if the admixture were derived at different points in the route of the chyle. Again, the proportions which the albumen and the fat bear to each other in chylous urine are the same which they have been found to display in chyle itself; in one case of chylous urine the albumen and the fat were equal, in another the albumen was twice as much as the fat; both these proportions have been found in chyle. There are further points of resemblance or rather indications of identity in the molecular base common to both, and present in no other fluid; in the corpuscles indistinguishable from those of chyle which have been found in chylous urine; and, lastly, in the peculiar deepening of colour under exposure, which both fluids have been known to present.

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[1] I once found two hyaline casts in the case of Eugenia P——, as subsequently related, but as none were ever seen again, though the disease persisted it was inferred that they were due to some passing and accidental condition and furnished only an apparent exception to the statement in the text.

[2] *Urinary Deposits*, 5th edit., p. 420.

The urine is sometimes rather lymphous than chylous; the molecular base, even with well marked chyluria, is not always present; the urine sometimes remains perfectly transparent, but becomes loaded with transparent jelly, not easily distinguishable from the fluid itself.[1] In such cases fat is probably entirely absent, as if the contents of the lymphatics instead of the lacteals had been poured into the urinary channels.

Duration.

The disease is of indeterminate, always long, duration, sometimes extending, usually with intermissions, over a considerable proportion of ordinary life. Dr. Elliotson mentions a lady then sixty-four years of age, who had had the disorder interruptedly for twenty-eight years ; and I have already referred to Quevenne's case of a woman who had it from the age of twenty-five to that of seventy-three without interval, and at seventy-eight was still suffering from it.

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[1] Goodeve's case. *Trans. of Med. and Phys. Soc. of Calcutta*, vol. viii. Quoted by Dr. V. Carter.

Looking at cases of which the history has been closed by death, we find that within the experience of Elliotson a woman died at the age of thirty, having had the complaint for twenty years ; in that of Lewis, one in whom it proved fatal together with general tuberculosis after sixteen years, with however an intermission of half the time. The same observer, however, mentions an instance in which it proved fatal at the age of sixteen. In this instance the disorder was, as proved by post-mortem examination, uncomplicated. Prout records a case in which it proved fatal at the age of fifteen, together with some inflammatory condition of the bowels.

Habit of intermission.

It is a habit of the disorder to be dormant or make long intermissions often without obvious reason, and as capriciously to return. A lady (further referred to at p. 1155) whose disease had presumably originated in India, showed no symptoms of it until five years after her return to England. With Dr. Elliotson's patient also, who had probably acquired the seeds of the disease in India, it did not attract her observation until nine years after her return to Europe ; it then continued for seventeen months, disappeared after bathing in the sea, and remained absent for thirteen years ; it reappeared after an attack of inflammation of the lungs, which had been treated by calomel and bleeding, and afterwards held its ground with shorter but still with occasional intervals. One of these ensued upon violent grief, another accompanied the formation of a carbuncle, and another occurred together with a second attack of pulmonary inflammation. Dr. Lewis refers to a native of Madras who had six attacks, each of about two months' duration, within the space of two years and a half.

The chylous condition has also its lesser variations, Lesser variations.

being influenced by food, posture, exercise, abdominal pressure and pregnancy. The effect of food has often been noticed, the urine of fasting being sometimes natural or at least clear or only bloody, while that passed after food is milky. In the case of Dr. Bence Jones's patient, the urine was most chylous after dinner, and least chylous before breakfast. It was more frequently chylous after animal than after vegetable food; and it was oftener free from chyle before breakfast when the diet was vegetable than when it consisted more of animal food.

My patient Eugenia P—— passed during the day what looked like rich milk or cream, in the night and before breakfast urine which was less opaque, often urinous in colour or conspicuously sanguineous. Carter noted, with regard to one of his Hindoo patients, that ingestion of flesh or wheaten bread increased the disease, while in the case of another, if he abstained from food for a whole day the urine ceased to be chylous.

One case has been recorded as exceptional, in which 'the urine passed during the day was clear and free from chyle, while that voided during the night and in the morning was deeply loaded with it.'[1] It may be suggested that in this case there was some peculiarity whereby the discharge was affected by posture, as sometimes occurs.

As a rule the urinary admixture is the most plentiful when the proper chyle channels are at their fullest, and on the other hand it is to be observed that conditions of health which interfere with nutrition are apt to cause the urine to revert to its normal state. Thus, in Dr. Prout's experience the urine ceased to be chylous during an attack of hepatitis with much fever, and again during severe mercurial salivation. The same suspension has been known to occur upon the appearance of a carbuncle,[2] during inflammation of the lungs, and on the approach of death.

The disorder is influenced also by movement, as a rule increased by exercise, mitigated by repose, though, in one of Rayer's cases, riding on horseback was thought to favour the return of the urine to its natural state; it is affected also by position. An instance is mentioned in which the urine ceased to be chylous when the patient lay on his right side. A tight belt round the belly and loins was found by Bence Jones to have but a slight restraining influence upon the discharge. The striking results in this respect of pressure upon the front of the lower lumbar vertebræ is related in another paragraph.

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[1] G. C. Dutt. *Lancet*, July 1862, p. 87.

[2] Elliotson's case. *Med. Times*, 1857, vol. ii. p. 287.

Among the conditions which influence the disease, perhaps pregnancy and its sequelæ are those which bear upon it in the most striking manner. The disorder often begins during lactation, or returns or becomes exaggerated after delivery. With Mr. Pearse's patient the chyluria three times appeared during lactation and twice subsided on its discontinuance. Dr. Roberts saw a case in which the disorder came on immediately after confinement. Dr. Lewis mentions one in which it began two months afterwards, and another in which the complaint appeared in the third month of pregnancy, passed off, and reappeared upon the birth of the child. Such cases cannot fail to suggest that the channels necessary to the perversion of the chyle are less patent when the uterus is full than when it is empty, as if they were pressed upon by its larger bulk. But conditions affecting in other ways the state of the pelvic vessels appear sometimes to influence the disorder. A case[1] is mentioned in which the urine always became chylous for eight days preceding menstruation; and another in which the chylosity was suspended for three years on the establishment of a hæmorrhoidal flux. Thus it appears to be promoted by turgidity, relieved by evacuation.

Superficial discharges of chyle associated with chyluria.

A discharge of chyle with the urine is in a certain proportion of cases accompanied by a similar flux from the surface of the body, usually from the lower part of the abdomen, groin, scrotum, or thigh. Such superficial discharges are apt also to occur where chyluria is endemic in persons who have not become subject to it; circumstances which suggest that the superficial and urinary discharges are common results of the same peculiarity of the absorbents, whatever that may prove to be. Dr. V. Carter has related several cases of these kinds, and shown how close is the resemblance between the discharge from the surface and the admixture with the urine.

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[1] Referred to by Roberts.

Dr. Carter describes the case of a Hindoo, the skin of whose scrotum was peculiarly corrugated and studded with small tubercles or pimples, which varied in size from a pin's head to a pea, and opened from time to time, discharging milky fluid, often to the amount of a pint daily. The inguinal glands on both sides were enlarged, soft, and doughy, and diminished in size under pressure. The urine was sometimes chylous, this condition alternating with the swelling of the inguinal glands, which was greatest two or three hours after a full meal. The fluid that escaped from the scrotum was, says Dr. Carter, probably chyle or a mixture of this with lymph. While flowing it assumed a decided rose tint, which increased on further exposure. It coagulated entirely in eight or ten minutes. The urine also coagulated more or less completely, and assumed after some exposure a pinkish colour. The microscopic characters of the two fluids were almost the same; chyle corpuscles were recognized in the urine; in the scrotal discharge corpuscles like those of lymph, together with the molecular base characteristic of chyle. The blood serum was quite clear. In such a case it is scarcely possible to doubt that the same chylous fluid escapes both into the urinary channels and also by way of the inguinal glands to the skin of the scrotum.

Instances have also been recorded in which, without any alteration of urine, milky, apparently chylous fluid has been discharged superficially from the lower part of the trunk or upper part of the thighs, always, it would seem, from some surface which is within the range of regurgitation from the lacteals or receptaculum, supposing valvular hindrance to be overcome. Pellucid or lymphous discharges have indeed been known to proceed from the upper parts of the body, as from the eyelids, and Dr. Lewis[1] has described an instance in which this discharge was 'slightly milky;' under the microscope, however, it displayed 'clear fluid' with numerous granular cells; the molecular base of chyle was apparently absent. The fluxes which have the characters of chyle, that is to say, are milky from molecular fat, are without exception within the anatomical range specified, a fact which is sufficiently suggestive that in these cases, as in those of chyluria, we have but the simple retrogression and escape of chyle. Such an instance is related by Dr. V. Carter. A Parsee youth had, in the cutaneous surface of the thigh, a few inches below Poupart's ligament, a small, hardly perceptible pimple, from which there occasionally issued a milky fluid, sometimes so copiously that in the course of a day a pint could be collected. Pressure just above the spot caused the flow to cease; when the spot itself was compressed the fluid squirted out as if from accumulating pressure behind. The inguinal glands were enlarged, soft, and doughy. The fluid resembled rich milk in appearance; it coagulated spontaneously, it was uniformly hazy, under the microscope contained blood corpuscles, granular cells, and oil globules—had, in short, the character of a chylous fluid. Another striking instance of this kind is related by Dr. A. B. Buchanan.[2] A woman forty-six years of age had a semi-excoriated surface as large as the palm of the hand upon the inner and posterior aspect of the left thigh. From this and from broken vesicles upon and about it flowed milky fluid so profusely that five ounces were collected in an hour. The fluid was often absolutely undistinguishable by colour and smell from pure new milk; it coagulated throughout after being passed, the mass breaking down on agitation. It was albuminous; under the microscope it displayed cells like the white corpuscles of blood, a molecular base like that of chyle, and a few fat corpuscles. Chemical analysis showed that it nearly resembled in its composition the chylous urine examined by Dr. Beale (see p. 1112), except that the crural discharge contained more albumen and less fat than the renal. Dr. Buchanan repudiates as anatomically impossible, and pathologically unnecessary, 'the theory that in such a case the discharge is actual chyle, which has found its way by the absorbents to the surface, and prefers to regard the flux as a functional affection of the glandular apparatus of the skin.' But that so small a cutaneous surface should yield so profusely and so long as the result of any change limited to itself is inconceivable; and if the skin but furnishes the exit—and it would seem that it can scarcely do more—to fluid derived from within, the characters of the discharge, as in the case of chylous urine, assimilate it so nearly to the contents of the lacteals that it is scarcely possible but to assign its origin to those channels. In Dr. Carter's case there was no altered extent of skin, but merely a pimple which gave exit to the discharge; so that in this case, at least, the theory of cutaneous secretion is inapplicable.

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[1] *On a Hæmatozoon inhabiting the Human Blood.* Calcutta, 1872, p. 13.

[2] *Med. Chir. Trans.* 1863, p. 57.

A case of the same sort came under the observation of Dr. Roberts of Manchester. A man always resident in Lancashire had a succession of sub-cutaneous abscesses in various parts, among others, one upon the abdomen. This was succeeded by an extensive vesicular eruption upon the front of the belly, between the level of the umbilicus and the groin. Some vesicles were scarcely visible to the naked eye, others as large as peas; all were at times filled with fluid which looked like rich milk, gelatinized when discharged, contained albumen, and displayed under the microscope fat molecules, sometimes distinct oil globules, and white corpuscles like those of blood. This exudation varied in colour according to the state of digestion, was pale or lymphous with fasting, milky after food. The vesicles discharged freely; one which was punctured at the rate of eight ounces an hour. The discharge was apparently identical with that which forms the admixture in chylous urine, and, indeed, on two occasions chylous urine was passed by this patient. He died with pulmonary tuberculosis. Nothing abnormal was detected about the thoracic duct or large lymphatic vessels. The affected skin was thickened and excavated with large lacunæ, of which the superficial vesicles formed the orifices. The sweat and proper cutaneous glands were not involved in the change, which Dr. Roberts regards as the development in the skin of an abnormal lymphatic structure, analogous to Peyer's patches or the lymphatic glands, which new structure is, in his view, not merely the outlet but the source of the discharge.

The pathology of cutaneous 'chylorrhœa' has been made the subject of further inquiry in regard to a case published by Mr. Sydney Jones in the 'Pathological Transactions' for 1875. The inner and back part of the right thigh and the cleft between the thigh and the buttock were covered with knotty swellings and varicose lymphatics, from which chylous fluid escaped sometimes to the amount of one or two quarts a day. Similar fluid also escaped from a tuberculated prominence on the shin, and the skin on some of the toes was tuberculated as in elephantiasis. When the discharge from the thigh was absent the inguinal glands swelled. Portions of the affected skin were removed from the thigh and one of the toes and minutely examined. They were traversed in both instances by large communicating chambers which were dilated lymphatics or lymphatic spaces. These were lined by an endothelium, but appeared to be destitute of any proper secreting cells. Veins were in close apposition to their walls, and in some instances appeared to communicate with their cavities. No filariæ were found in the blood or tissues, but the superficial dilatation of the lymphatics, together with the swelling of the inguinal glands when the discharge was absent, are enough to suggest a similar state of the deeper and larger channels, and the probability of regurgitation from the proper chyle vessels. This case affords no support to the idea of a local chylous secretion ; and indeed it is probable that, with the knowledge which has now been gained, those who formerly held this view will no longer maintain it.

As touching the relationship between cutaneous and urinary discharges of chyle, some cases recorded by Dr. Lewis have especial interest. Dr. Lewis gives examples of the concurrence of chyluria and elephantiasis, and relates an instance of the latter disorder in which from the scrotum, which was the part affected, exuded by minute orifices a chylous fluid in which living filariæ were detected.[1] We here see a superficial chylous discharge associated, not indeed with chyluria, but with a cause of chyluria. The evidence adduced by Dr. Lewis suffices to show that all three conditions, a discharge of chyle both by the skin and with the urine and elephantiasis, are alike associated with filariæ. The discharge from the eyes already referred to was also found by Dr. Lewis to contain these parasites.

THE FILARIA.

The pathology of chyluria, together with that of superficial chylous discharges and of elephantiasis, has been reconstructed, I may almost say created, by the recent discovery of the filaria sanguinis hominis and the larger worm, also a denizen of the human body, of which the filaria is the offspring. The accumulated evidence that the filaria is nearly always to be found in the blood at certain times, in concurrence with superficial or urinary chylous discharges, and often in the urine when the flux occurs with this secretion, makes it necessary to preface the morbid anatomy of these disorders with a description of the parasite. The great discovery of Lewis, for it is no less, and the observations which have been added, especially by Bancroft, Manson, and Mackenzie, have not only made our previous knowledge coherent and intelligible, but have removed the pathology of chyluria out of the region of speculation and guesswork to that of knowledge, incomplete as yet in some of its details, but enough to give the assured outlines of a striking and even astonishing picture.

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[1] *The Pathological Significance of Nematode Hæmatozoa*, p. 46.

Filariæ of dogs.

It had long been known that dogs, particularly the pariah dogs of India, were liable to be infested with a peculiar round worm, to which from its red colour the name filaria sanguinolenta was given, which lodged chiefly in the walls of the œsophagus and aorta, and discharged its ova according to circumstances into the alimentary canal or circulation. More recently another similar parasite, to which the name *filaria immitis* was given, was ascertained to exist chiefly in the dogs of China, taking its residence in the right ventricle, and pouring living embryos into the blood. The parent worms in both these cases are of considerable size, the filaria sanguinolenta approaching four inches in length, the filaria immitis exceeding six. The embryos, which in both cases are abundantly distributed throughout the systemic blood, nearly resemble the filaria sanguinis hominis, which will be presently described.

Filaria sanguinis hominis.

The minute human hæmatozoon, whose existence as such was made known to us by Dr. Lewis at Calcutta in the year 1872, is a minute vermiform creature about forty-six times as long as it is wide, and whose width is about that of a red blood corpuscle. Its structure is nearly simple, granular matter within a hyaline sheath, with a point at each end which appears and disappears with movement, one passing as a tail the other as a tooth. Dr. Lewis found six of these in a single drop of blood from the ear, and gave 700,000 as an approximation to the number contained in the whole body. This estimate has been very greatly exceeded since it has been recognised that it is the habit of the parasite to come abroad at night. Dr.

Mackenzie calculated that a patient whose case he has reported had nightly from thirty-six to forty millions of embryo filariæ in his blood. The worms show much vivacity among the corpuscles, throwing them aside by their active serpentine movements. It was at once conjectured that these minute creatures were the young of a larger worm, and the surmise was verified by the discovery of the parent on December 21, 1876, by Dr. Bancroft of Brisbane. The mature form, a worm of the nematode class about the thickness of a human hair and three or four inches long, was first found in a lymphatic abscess of the arm, and afterwards in hydrocele fluid obtained from patients who were known to be infested with embryonic filariæ. The adult was minutely described by Dr. Cobbold, from specimens sent by Dr. Bancroft, and named filaria Bancrofti, different names being thus awarded to different stages of the same parasite. The annexed figure is copied from Dr. Cobbold's description.[1] I have added another from a photograph published by Dr. Stephen Mackenzie, which enables the immature offspring as it is found in the blood to be compared in size with the corpuscles. Dr. Lewis himself found the parent worm at Calcutta on the 5th of the following August, in a scrotum infiltrated with chylous fluid in connection with elephantoid disease.[2] Two white threads were found in a blood-clot, which proved to be male and female specimens of the adult filaria. The female contained ova with embryos identical with those which Dr. Lewis had already found in the blood. The occurrence of these creatures in pairs in the remote recesses of the human body shows the efficacy of the sexual instinct, in virtue of which one worm follows and eventually finds another within a maze to which that of Fair Rosamond was comparatively uninvolved. Dr. Manson[3] has recently

Filaria Bancrofti.

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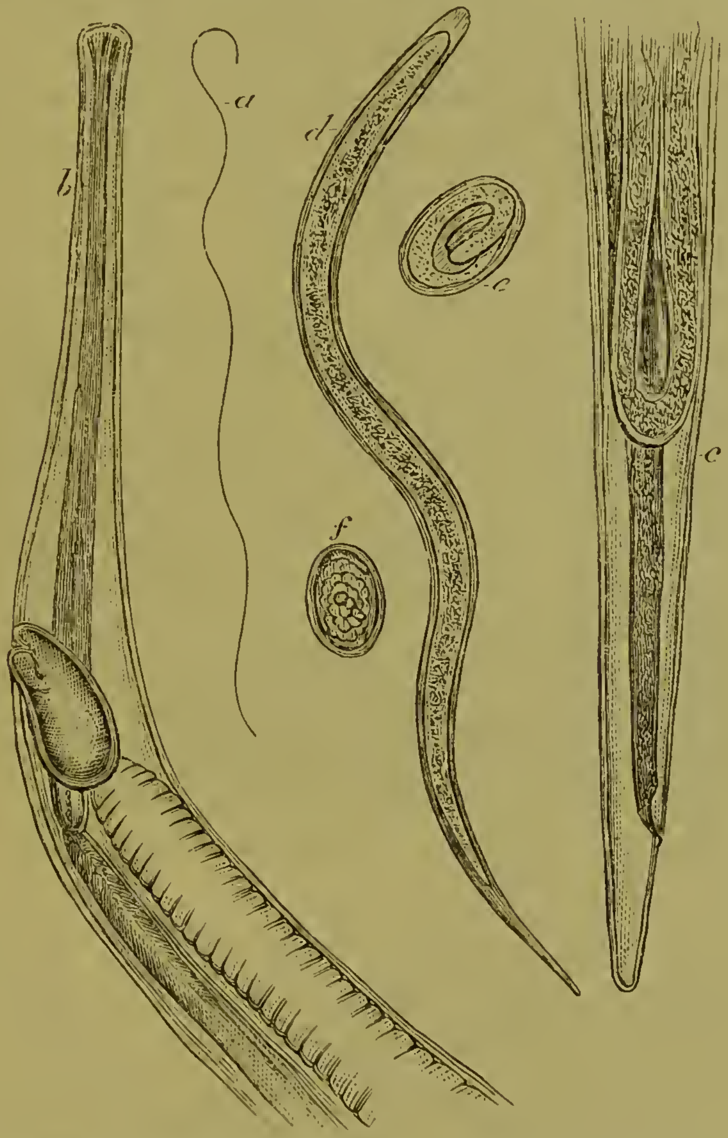
[1] *Parasites*, 1879, p. 188. 'Discovery of the Adult Representative of Microscopic Filariæ.' Dr. Cobbold. *Lancet*, July 14, 1877, p. 70.

[2] 'Filaria Sanguinis Hominis' (mature form). By Dr. Lewis. *Lancet*, September 29, 1877, p. 453. 'On Filaria Bancrofti.' Cobbold. *Lancet*, October 6, 1877, p. 495.

[3] *Path. Trans.*, vol. xxxii. p. 285.

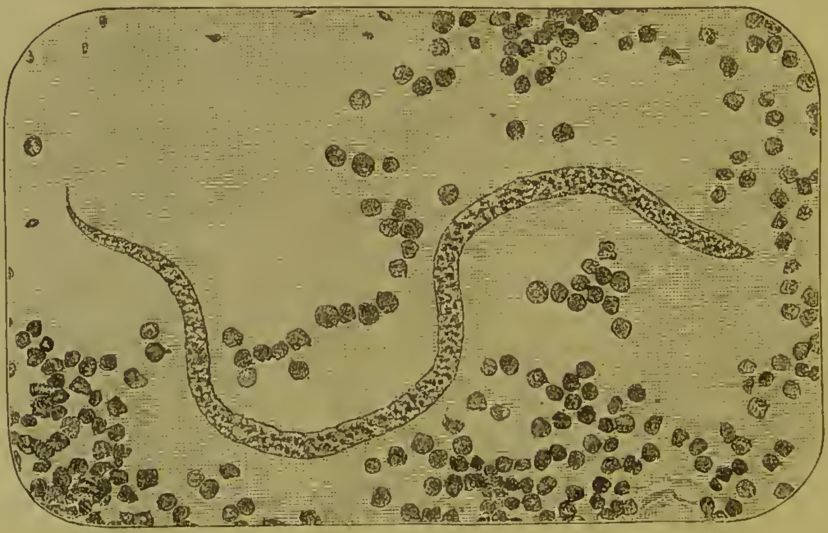
demonstrated the position of the parents in a dilated lymphatic belonging to a *lymph-scrotum* which he had recently amputated. The creature is viviparous, normally discharging its offspring extended and free; miscarriage, however, appears to be a frequent accident, in which case the ova are discharged unhatched, with the worm curled up within, thus presenting a larger bulk than when the process is more happily conducted, and producing pathological consequences which will be presently adverted to.



Filaria sanguinis hominis, or Bancrofti. *a* female (natural size); *b* head and neck (× 55 diam.); *c*, tail; *d*, free embryo (× 400 diam.); *e*, egg containing an embryo; *f*, egg showing the yolk. After Cobbold.

The mosquito in relation to the filaria.

Many valuable observations have since been added throwing light upon the habits of the parasite, its means of transmission, and its relations to disease. Dr. Manson,[1] in China, in the year 1877, provided the next step by a discovery not inferior in interest to any that had been already made. Believing that the asexual embryo did not attain maturity in the place of its birth, but required, after the manner of parasites, to be transferred to another animal for further development, he sought for the nurse among the insects that feed on blood, and found it in the mosquito. Dr. Manson, suspecting this insect, induced a Chinaman who was infested with filariæ to sleep in a house where mosquitoes were wont to congregate. A number of these, which had been attracted by means of a light, were shut up with the man, and in the morning found upon the walls in a state of repletion. Filariæ were abundantly found in their distended stomachs, and Dr. Manson ascertained by numerous observations that upon entering the mosquito the more fortunate of the filariæ began a process of development which, in from four to six



Filaria in human blood. After photograph published by Dr. Mackenzie.

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[1] Dr. Manson, 'On the Filaria Disease at Amoy.' *Customs Med. Reports.* China, 1877. 'Lymph-Scrotum, showing Filaria in situ.' Dr. Manson. *Path. Trans.*, vol. xxxii. p. 285.

days, transformed each into a somewhat complicated animal, with an œsophagus, rudimentary generative organs, and papillæ upon its head, perhaps for boring or attachment. The filariæ are said to be found in the blood in the mosquito's stomach in larger proportion than in that of the man from which it has been taken, as if the parasites were especially attracted by the insect. The mosquito, of which only the female is capable of thus abstracting blood, retires, when replete, to the neighbourhood of water, to digest its meal and mature its ova. At the end of about five days both processes are complete; the blood, and possibly many of the filariæ, are digested, but the survivors, still within the mosquito, have become transmuted into the formidable parasite which Dr. Manson has described. The insect now dies, probably falling into the water, upon which she has already laid her eggs, and the now vigorous filariæ, if they have not already escaped with the ova, either bore their way out of the mosquito, or fall out upon its decay, to enter the water and probably be swallowed by the animal which is destined to become the seat of its further growth and completion. The details of this, the last stage of its career, have not been followed, but there is little doubt that the creature makes its way by boring into a suitable lymphatic channel, and there completes its growth into the tangible worm which has been already described; is there, by good hap, joined by one of the opposite sex, and the species continued by the pouring of the embryonic filariæ into the lymphatic channels, from whence they reach the blood and the mosquito.

Nocturnal habits of the filaria.

The embryo filaria is, as Dr. Manson pointed out, of nocturnal habits; abundantly to be found in the blood during the night, not to be found during the day. He found them to present themselves at about 7 o'clock in the evening, to increase up to midnight, and to have disappeared by 8 or 9 in the morning. Dr. Mackenzie[1] added the observation that this periodicity depended upon sleep: on reversing the hours of sleeping and waking in a case under his observation, the filariæ changed their course of proceeding, coming out while the patient slept, and remaining hidden during his waking hours. What becomes of the filariæ, or where they retreat to during their disappearance, we have no evidence to show.

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[1] *Path. Trans.*, vol. xxxiii. p. 401.

Their effects upon the human host.

These parasites, which obstruct the lymphatics and teem in the blood, do, on the whole, less harm than might have been expected. The embryos appear to pass through the capillaries without difficulty, and to have no tendency to cause obstruction. It might be supposed that each filaria would become a centre of coagulation and an embolus; but the blood appears to be as tolerant of the animal as of its own corpuscles, and to allow it as free passage through its smallest channels. But it is not so with the ova, which have been seen unhatched in the lymphatics, in the blood, and in the urine, as the result, probably, of accident or abortion; these, as Dr. Manson has shown, present at least five times the diameter of the outstretched filaria, and, though passing easily along the larger lymphatics into which they are born, are arrested in the smaller channels of the first lymphatic gland they reach. Here they become impacted, and, as the process goes on, accumulate in sufficient numbers to make the gland impervious, and give rise to the localised lymphatic congestion which is the essential fact of elephantiasis, lymph-scrotum, and similar conditions. As the result of obstruction by such means of lymphatic glands, we may have a series of affections which are limited to the tributaries of the gland concerned, and are often superficial. But other affections may ensue from the occlusion, by the parent worms, of the larger lymph and chyle channels. These have been demonstrated, as already stated, in a scrotal vessel, and there can be no doubt that the deeper channels, among others the thoracic duct, are liable to be similarly stopped.

Recent as our knowledge of the filaria is, we have already been provided with extensive information as to its

Their frequency and occasional harmlessness.

pathological effects and the absence of them. Dr. Manson found, as the result of systematic search, that of every ten Chinamen at Amoy, taken at random, the blood of one contained filariæ. But many of these were apparently in perfect health. Of 195 persons in this condition, ten were found on examination to be filarious, so that to harbour this parasite is not necessarily injurious.

Disorders present with filariæ.

But we have evidence from Lewis, Bancroft, Manson, and others, of a large variety of disorders which occur together with this parasite, and are presumably caused by it. A large proportion of these are of the elephantoid type, elephantiasis especially of the scrotum, what is known as lymph-scrotum, and enlarged and varicose inguinal glands. Dr, Manson found that of sixty-three persons with one or other of these affections, thirty-six were filarious. Passing attacks of fever, known as elephantoid, appear to be of frequent occurrence. Hydrocele, orchitis, inflammation of the scrotum, and a number of superficial affections of the lymphatic system, have been recorded in the same relation—cutaneous lymph-vesicles, chylous and lymphous discharges, a disorder of this class known in Brazil as crow-crow, and a peculiar form of facial steatoma. Beside results of obstruction, superficial abscesses, presumably due to the death of the parent worm, have been repeatedly observed, as also have attacks of diarrhœa and dysentery. As the only morbid result due to the embryo in the blood, Dr. Manson mentions ulceration of the cornea.[1]

Filariæ have been found with leprosy;[2] it is yet too early to say whether the concurrence is accidental or necessary. The list may be closed with chyluria, which, whether associated with some elephantoid affection or occurring alone, is one of the most important, and in some districts one of the most frequent of the consequences of the parasite. Dr. Manson at Amoy found elephantiasis far more frequent than chyluria. Dr. Bancroft at Brisbane found chyluria more frequent than any superficial localisation of the disease, though not so frequent as all of them together. Among thirty-one cases of disease, presumably of filarious origin, Dr. Bancroft found chyluria in eleven instances; some superficial affection, probably of the same origin, in twenty.

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[1] *Further Observations on the Filaria Sanguinis Hominis*, p. 8.

[2] Dr. Bancroft. *Lancet*, Feb. 1, 1882, p. 175.

MORBID ANATOMY AND PATHOLOGY OF CHYLURIA.

Passing from the filaria in general to its particular result chyluria, I may briefly state what is known with regard to the morbid anatomy of that condition, together with that of superficial chylous discharges. There is still room for conjecture in some details, though enough has been ascertained to place our knowledge of both upon a simple mechanical basis.

Post-mortem appearances.

With regard to chyluria we are, to begin with, indebted to Prout,[1] who examined the kidney of a girl who had died with chylous urine at the age of fifteen, and found it to be perfectly healthy—the immediate cause of death was inflammation of the bowels. Not to refer to equivocal instances, the next is related by Dr. Priestly. The subject was a boy twelve years of age, who had passed the greater part of his life in the Mauritius and Ceylon. Some days before death the urine had lost its chylous character, this being coincident with a rapid change for the worse, the patient sinking by asthenia. Both kidneys were extensively diseased, the distinction between the cortical and tubular portions was lost, and the vascular network on the surface of the healthy organ obliterated. The microscope showed the whole structure to be fatty, as in some of the advanced forms of Bright's disease. The liver was loaded with fat, and the muscular fibres of the heart had lost their transverse striæ and were replaced by oil globules.[2] There was also tubercular disease in the apex of one lung. For a third post-mortem we are indebted to Dr. Isaacs.[1] The case was that of a Spanish sailor who had had the disorder at irregular intervals for three years. Both lungs were studded equally and throughout with miliary tubercles, from the size of a grain of sand to that of a mustard or hemp seed. Under the costal pleura they were also in countless numbers. All the other organs were healthy, with the exception of small deposits of yellow tubercular matter in the interior of the mesenteric glands. In the substance of the prostate were three tubercles about the size of buck-shot. 'The structure of the kidney was decidedly healthy—the only morbid appearance was the presence of a very few small and scattered tubercles, which did not apparently interfere with its functions.'

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[1] Edit. iv. p. 119.

[2] *Edin. Med. Journ.*, 1856, p. 945.

I have already referred to a case in the experience of Dr. Roberts, in which a chylous discharge issued from the skin of the abdomen. Chylous urine was passed on two occasions; but as death did not occur until more than three months afterwards, little is to be inferred from the state of the urinary organs. The bladder, which was minutely examined, and the kidney, were healthy. 'No enlargement or unnatural condition of the thoracic duct or of the lymphatic vessels or glands could be detected.' The condition of the skin has been already referred to.

Dr. Lewis records the post-mortem appearances in the case of a European woman who had died in India with chyluria, which she had had with intermissions for sixteen years. Hæmatozoa had been found numerously in the blood, and in the urine.[2] The immediate cause of death appeared to have been tuberculosis; tubercles and vomica were found in both lungs, and there were ulcers of the same character in both the small and large bowel. The liver was soft and fatty. 'The kidneys presented nothing abnormal to the naked eye.' A further examination showed that several of the pyramids, especially near the apices, had a smooth tallowy appearance, suggestive of lardaceous disease. No iodine reaction could be obtained either upon the kidney or liver. 'When longitudinal sections of the kidney were subjected to microscopic examination, numerous translucent oil-like tubules, of a somewhat varicose appearance, could be observed running alongside the uriniferous tubes, as if the lymphatic or minute blood-vessels of the part had become plugged. These sections when placed in boiling ether, and afterwards subjected to prolonged maceration in it, did not appear to be materially affected by the process—the translucent oil-like tubules being quite as evident as before. No other morbid changes could be detected in either the tubular or cortical tissue of the kidneys, but in every fragment, no matter from what part of the kidney removed, numerous microscopic filariæ were invariably obtained. On slitting open any portion of the renal artery, from its entrance into the kidney as far inwards as I was able to follow its ramifications, and scraping the inner surface, numerous hæmatozoa could always be obtained. The renal vein when similarly examined also yielded specimens of the filariæ, but they did not seem to be so numerous in it. The vessels themselves did not appear to be diseased.' It is to be added that the same parasites were also found in the supra-renal capsules. The condition of the bladder and urinary passages is not mentioned.

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[1] *Amer. Journ. of Med. Science.* 1860.

[2] Lewis, *On a Hæmatozoon inhabiting the Human Blood.* 1872. Pp. 17 and 33.

Dr. Mackenzie's case with dissection of lymphatics.

The next, and that a most valuable contribution to our knowledge in this matter, was made by Dr. Stephen Mackenzie,[1] some of whose illustrations I have ventured to reproduce. A soldier, who had been born in India, and passed his life in that country and Burmah, until he came to England at the age of twenty-six, displayed, a month after his arrival, the symptoms of chyluria. These were such as are ordinarily met with, excepting that he had much pain in the back, shooting into the left testicle. He was admitted into the London Hospital in July 1881, having then had the complaint in question for about four months. Filariæ were abundantly found in the urine and the blood; in the latter they were ordinarily present at night, not in the day. In this case Dr. Mackenzie ascertained that this periodicity depended upon sleep, the hæmotozoa ceasing to be evident at night and becoming so by day, when the times of sleeping and waking were reversed. On October 20 the patient was allowed to go out of the hospital for the day. It was cold and windy, and he went without his overcoat. At 3 A.M. the next morning he had a severe rigor, followed by vomiting, headache, pain in the epigastrium and right hypochondrium, a temperature of 104°, cough without expectoration, and pain in the right side, which the cough increased. On the 23rd there was pain in the left shoulder joint, and two days later an abscess presented just above the left clavicle, half an inch external to its sternal end. On November 4 there was much pain on the right side of the chest, blood-streaked expectoration, and pleural friction on both sides. The abscess, which had now extended to the front of the left sterno-clavicular articulation, was opened, but neither embryo nor parent filariæ discovered in the several ounces of pus which escaped. On the 29th it became necessary to open a second abscess, which had appeared on the arm, just below the acromion.

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[1] *Path. Trans.*, vol. xxxiii. p. 394.

At the outset of the attack the urine had ceased to be chylous, containing only blood and albumen; these lessened, and finally disappeared, which they had scarcely done when the patient was attacked with symptoms of cystitis, the urine becoming mucous and ammoniacal, containing half albumen and much pus. The febrile conditions increased, the breathing became more embarrassed, and he gradually sank and died on January 10, 1882.

After October 22 not a single filaria was found in the blood, which was systematically examined, though up to this date they had been exceedingly numerous.

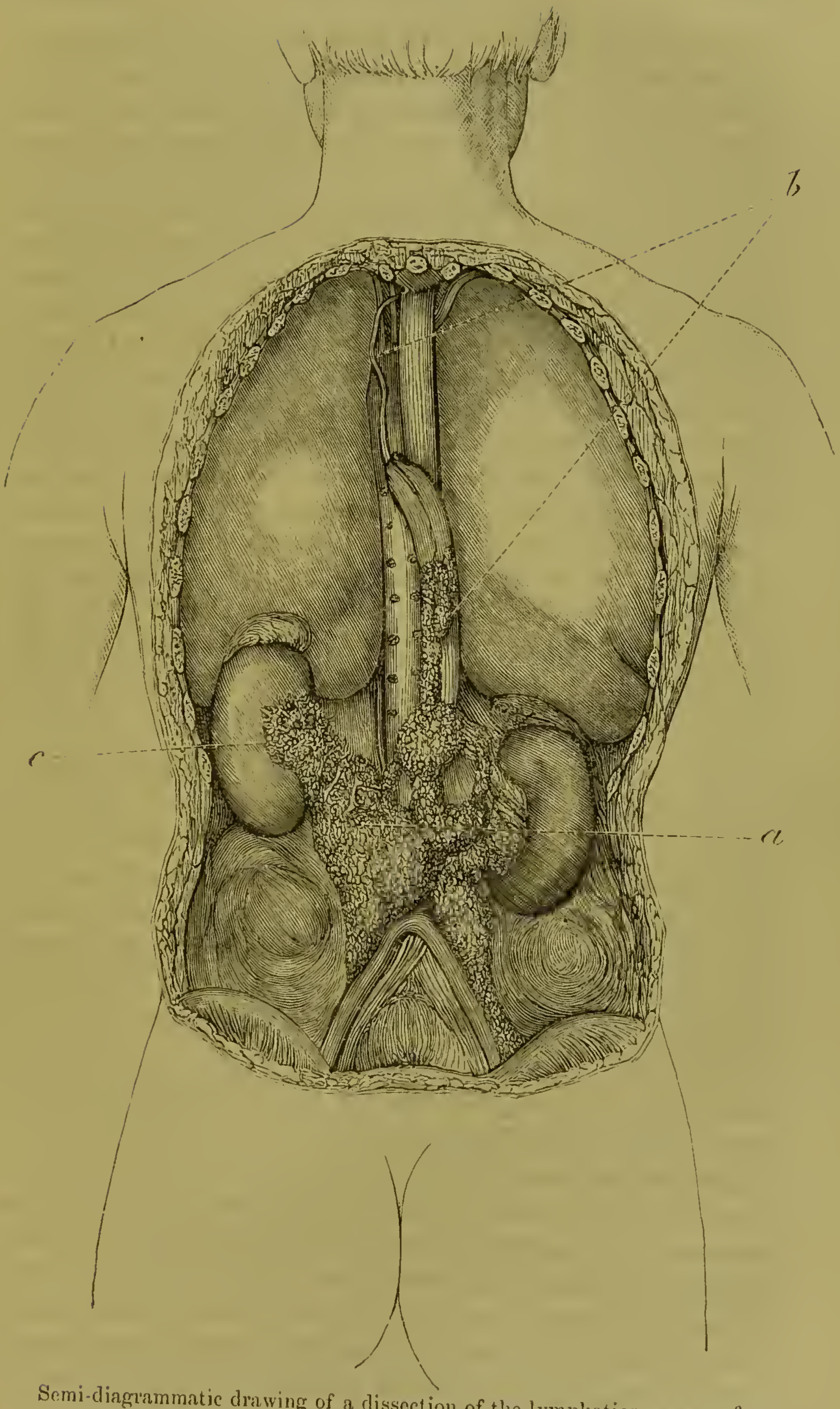
On post-mortem examination empyema was found on the right side, simple pleurisy on the left. The mucous membrane of the bladder was thickened, contained extravasations, and was covered with ropy mucus. The kidneys were slightly enlarged, and in a condition of early suppurative nephritis. Several wedge-shaped patches existed in the cortex, with the base at the surface of the organ, and reaching down to the medullary cones. These patches were of a pale, yellowish-grey colour. No abscesses were found in the kidneys, or elsewhere.

The deeper tissues were removed, and the abdominal lymphatics dissected by Mr. Fenwick, and described by Dr. Anderson as follows:—

'The thoracic duct commences in a dense mass of lymphatic tissue and glands, which extends from the bifurcation of the aorta below to the level of the aortic opening of the diaphragm above. Looked at from behind, this mass occupies the whole of the space between the kidneys, and is continuous below with the chains of lymphatic tissue on the iliac arteries. The mass consists very largely of enormously dilated lymph sinuses, which can here and there be inflated. The receptaculum chyli commences by two large lymph sinuses, about the size of a pencil, one from each side of the aorta, and is joined opposite the aortic opening of the diaphragm by a third large sinus, about the same size. The duct now ascends, sinuous and much pouched, for three to four inches, varying in diameter from three-eighths to half an inch, pervious for the first inch and a half above the aortic opening of the diaphragm, then filled with a loose clot for an inch and a half, after which it is lost in a tough, thick mass (? inflammatory). The occluded part of the thoracic duct, when opened, was found to contain a very long twisted clot, tapering at the end' (which, when subsequently examined, did not present any parasitic structures). 'About four inches above this point, when it can again be traced, although still involved in dense tissue, it is the size of a small crow-quill, impervious, and tending to the left side behind the aorta. At its termination in the angle between the left subclavian and internal jugular veins, it passes through a mass of lymphatic tissue, is pervious, and about the size of a goose-quill. As stated, the iliac, the lumbar, and the renal lymphatics are very much enlarged, and the enlargement is specially marked in the left iliac and left renal lymphatics. Scattered throughout the left renal lymphatics are numerous hard round masses, some the size of a pea, but mostly smaller. These masses manifestly occupy the lymph sinuses.'

Dr. Mackenzie supposed that during or just after the rigor which marked the beginning of the last stage of the illness, the parent worms became dislodged from their position in the receptaculum, or one of the contiguous lymphatic trunks, and that one or more was carried to the termination of the thoracic duct in the neck, and there set up the double pleurisy and the abscess near the sterno-clavicular joint.

It is to be presumed that the death of the parent worms



Semi-diagrammatic drawing of a dissection of the lymphatics, as seen from behind, in Dr. S. Mackenzie's case. *a.* greatly enlarged iliac lumbar and renal lymphatics; *b.* thoracic duct, passing through inflammatory material; *c.* calculi in left renal lymphatics.

accompanied or preceded their dislodgment, and thus made them greater sources of irritation than they otherwise would have been. As no traces of them were discovered after the death of the patient, it is to be presumed that their bodies had become disintegrated.

This case is important, as showing, by the dilated and varicose condition of the lymphatics between the thoracic duct and the kidneys, that chyluria, in this instance at least, was associated with obstruction in some part of the lymphatic system, a condition which had been before inferred to exist, but never as yet demonstrated. It still remains uncertain at what point the obstruction was, but we cannot have to wait long for further particulars. I think it may be considered as certain, from the fact that casts of the renal tubes are not found in chylous urine, that the escape is not into the kidney tubes. The particulars of the dissection, as will be seen from Dr. Mackenzie's representation, appear to indicate that the point of chylous discharge was either into one of the pelves or ureters, or into the bladder. The channels most conspicuously dilated were those in the neighbourhood of the left hilum, and it is probable that the communication was in or near the pelvis on this side.

Pathological theory of the disease.

To proceed to the pathological significance of the facts, it is in the first place certain that the admixture with the urine is obtained directly from the chyle channels, and not eliminated from the blood-vessels. The identity of the urinary addition, both in substance and shape, with the contents of the further lacteals and thoracic duct, is, as has been already shown, sufficient warrant for the presumption that the urinary organs import rather than manufacture the constituents which are foreign to their secretion. As to the route by which the chyle reaches the urinary cavities, we may at once put aside the secreting structure of the kidneys as not involved in its course. If the sensitive renal tubes were for long traversed by a material so novel to their habit and purpose, it might be taken as certain that obvious changes in the gland, probably of an inflammatory kind, would ensue; but this does not occur—after years of the disorder the kidneys have been found to present to a critical eye no departure from the natural state. In Dr. Priestly's case, where the kidneys were fatty, this change was shared by other organs, and may probably have been connected with the tubercular disease which was present. The necessary properties of the urine do not appear to be impaired by the disease, neither do uræmic or proper renal symptoms ever result. Again, though chylous urine is often so fibrinous as to coagulate within the body, yet casts of the renal tubes are not found in it. It would seem that they could not fail to be formed did the fibrinous mixture traverse the ducts, so readily in almost all circumstances of renal disease does fibrine solidify in these narrow and tortuous channels. Presuming, therefore, that the chylous matter is not a renal discharge, it can only be attributed to some part of the urinary mucous membrane. Taking this together with the cutaneous manifestations of what may be termed chylorrhœa, the occasional association in the same person of both the urinary and the cutaneous form, and the limitation of the cutaneous variety to the parts of the body the absorbents of which, like those of the bladder, run by a short and nearly direct course into the lower end of the thoracic duct, it is not possible to doubt that, whether affecting the skin or mucous membrane, the disorder is essentially the same, consisting in each case of a regurgitation of actual chyle from its proper vessels. The chyle after reaching the lower part of the thoracic duct by the lacteals, instead of pursuing its upward course is turned backwards along the lymphatics, which proceed respectively to the urinary mucous membrane and the adjacent skin.

The absorbents from the pelvis, lower limbs, and neighbouring parts enter the thoracic duct at its lower part, close to the point where the contents of the lacteals are received; should the chyle meet with any obstruction in its upward flow, it is into these that it would be diverted, supposing their valvular arrangement should prove insufficient to prevent a retrograde current within them. The lymphatics of the bladder and of the parts adjacent to the groin are of great size, and are comparatively short, so that a regurgitating current would soon reach their extremities. A backward stream from the receptaculum would pass first into the absorbents which accompany the iliac arteries; thence numerous and wide channels lead to the bladder, while others enter the inguinal glands to pass downwards to the thigh and upwards over the abdomen. The pelves of the kidneys and the ureter are also in close communication with the thoracic duct, and within easy reach of regurgitation. It must be allowed that, notwithstanding the valuable dissection which we owe to Dr. Stephen Mackenzie, we are still in doubt as to the exact part of the urinary mucous membrane upon which the chyle is discharged. The constant occurrence in chylous urine, as I have already pointed out, of large globular cells such as belong to the bladder, would suggest that its wall is the place of the leak, while the same inference must be drawn from a case I have related (p. 1144), in which the discharge was constantly, though temporarily, arrested by astringent injections into this cavity. At the same time it must be allowed that there is usually, though not always, complete absence of vesical irritation (see case of Mrs. E——, p. 1155, as an exception to this statement), while if there be pain with chyluria it is usually in the lumbar region. We must, therefore, regard the place of the discharge of chyle as still uncertain. It may not always be the same.

As to the hindrance which the valves of the lymphatics present to the retrograde current, it is evident that a certain amount of dilatation is all that is needed to make them inefficient.

It is possible that there may be more than one cause which leads to the regurgitation. Any obstruction in the thoracic duct, whether by parasites or otherwise, would conceivably cause it; but we are justified in putting aside other causes of stoppage as at least exceedingly infrequent. Knowing as we now do that an arrest in the lymphatic system leads to regurgitation and discharge, we can but infer from the absence of such results that the thoracic duct has a power of evading aneurisms and growths which is not possessed by either veins or arteries. The mere circulation of embryo filariæ does not appear to be productive of chyluria, or indeed of any other prominent symptom; this flux can be due only to obstruction in the thoracic duct, or large channels between it and the urinary organs. The completion by Bancroft of the discovery of Lewis, and the location of the parent worms in the large absorbent vessels, supplies the mechanical hindrance and occasions the regurgitation to which the symptoms are due. The constant admixture of blood with chylous urine is presumably to be explained in this view. Injury to the thoracic duct may easily be supposed to affect its valvular entrance into the subclavian vein, so that not only chyle but blood may regurgitate. The blood in such urine might possibly proceed from the coats of the bladder; but it could scarcely be derived from the secreting structure of the kidney without such injury to the gland as our observations, scanty though they are, are sufficient to show does not exist. If the hæmatozoa were to escape from the blood-vessels into the tissue, so as to open connection between channels not normally communicating, it is impossible but that inflammation would accrue, probably in the form of diffuse suppuration.

With regard to the minority of cases of chyluria which originate in Great Britain, it is to be borne in mind that the mosquito occasionally visits our shores, and it is possible that the filaria may be introduced as in countries where this insect is more abundant. It is also possible that there may exist other causes of lymphatic obstruction which have not yet been identified. In a case I have related (p. 1144), no filariæ were found in the blood or urine, but this does not prove that the disorder was not parasitic, since if only a single worm, or worms only of one sex existed, they might have been sufficient for obstruction though not for propagation.

TREATMENT.

As to the radical cure of chyluria by the destruction of the parasite, we know of no drugs which are effective in this respect. The thoracic duct is in more immediate reach of absorption by the stomach than are the systemic blood-vessels, though scarcely nearer than the portal; but it is not consistent with our experience of the Bilharzia that an animal in the latter situation should succumb to anything which the tissues can endure; and it is not to be expected that the filaria will prove more vulnerable. Without looking for specifics we must be content to seek measures of relief, much encouraged by the consideration that if we can only maintain the patient against the disease for a time, it will often, with apparent caprice, terminate or become suspended.

Pressure.

Considering that the disease does harm chiefly by the diversion and loss of the nutritive fluid, it is obvious that it may be of service to prevent this even temporarily. I have made use of pressure, directed as nearly as might be upon the lymphatics between the bladder and the thoracic duct, in the hope of arresting the regurgitating current. Passing as these vessels mainly do with the internal iliac arteries, and thence by the lumbar glands, it would seem that the front of the lower lumbar vertebræ affords the only position at which pressure from without could be effectively brought to bear upon them. A reference to the case related at p. 1144 will show to how large an extent the chylous discharge can be thus controlled.

Dr. Bence Jones was led to the belief that compression of the kidney might be serviceable, and to this end used in one instance a tight belt around the loins, but the results were insignificant. The enlarging uterus appears to exert the necessary pressure more effectively. The relation of the disorder to pregnancy is indeed of interest in several respects. The favourite time for its accession or return appears to be the period of lactation; during pregnancy we hear little of it; in an instance mentioned by Dr. Lewis[1] the disorder began in the third month, passed off five or six weeks later, and returned after delivery. The suspension of the complaint corresponds with the presence of the uterus in the abdominal cavity, while the peculiar liability of the period of lactation to its attacks may be connected with the abnormal relaxation of tissue which follows the emptying of the uterus and the continuance of lactation.

Vesical injections.

I have elsewhere related with circumstance which makes more than a brief reference unnecessary (case of Eugenia P——, p. 1144), the effects of the injection into the bladder of perchloride of iron. The immediate result in arrest of the flux was beyond question, but the remedy in strength enough to be of service was not indefinitely tolerated, and at best it aims only at the point of issue, not at the source of the discharge.

Constitutional measures.

Putting aside local measures, the indications are two: to constringe, and to compensate. With regard to the first, Bence Jones thought that the discharge was controlled by gallic acid, given in the amount of 60 grains a day; and other observers have attributed good results to the astringent salts of iron. How far the discharge is under the control of astringents of this sort may be doubted. There can be no doubt as to the importance of compensation by diet and nutritious drugs. The constitutional symptoms of the disease, so long as it remain uncomplicated with tubercle, are simply those of inanition. The discharge involves the loss both of the fatty and of the nitrogenous elements of food, so that the diet must be liberally adjusted in all respects. Cod-liver oil and iron were obviously indicated by the wasting and pallor of my own patient, and were given with the best results. Mangrove bark has been recommended as an empirical remedy, but we must have more evidence than has yet been adduced before we attribute any decided benefits to its use.

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[1] *On a Hæmatozoon inhabiting Human Blood.* 1872. P. 9.

The following cases may be of interest, as presenting the clinical aspects of the disorder as witnessed in England.

Case of chyluria of English origin.

On June 22, 1877, I happened to be at Wandsworth, in consultation with Dr. John Marsh, who took me to see, as one in whom I should be interested, a young woman who was the subject of chyluria. She was in bed, so weak that she could scarcely stand, quite unable to walk downstairs, exceedingly emaciated, so depressed that she cried whenever spoken to, very anæmic, as evident by the general pallor of the skin, which was dry and harsh, but preserving, in spite of all, some healthy colour in the cheeks. I was shown, as having been recently passed as urine, about a quart of what looked like rich milk, at the bottom of which was displayed, on decantation, ragged shreds of sanious clot.

October 1875.

Her name was Eugenia P——, she was twenty-one years old, a dressmaker, unmarried. She had been born at Dalston, and never left England, nor indeed been far from London, except that once she went to Manchester, but not until after the complaint had come on. There was nothing to throw light upon the origin of disease, which presented itself suddenly in October 1875. She was then living in London and in good health, excepting that she was suffering from a severe cold, chiefly in the nose; she had been at needlework all day, and at night, without feeling anything specially amiss, observed that the water looked like milk. It continued to present this appearance at night, after taking food, while that passed in the morning had a pink colour. She occasionally passed pink lumps, especially in the afternoon. She had no local or special symptoms, and for three months her general health remained undisturbed. She then gradually lost her appetite, found a sense of nausea, became thin, and so weak that she was no longer able to work. With three months' rest she improved in general health so as to be able to resume her employment, but in December 1876 she again broke down, with headache, sickness, and prostration, and fell into the state in which I saw her, without having had any intermission of the urinary discharge from the time of its appearance until her admission into St. George's Hospital, on June 26, 1877.

First admission June 26, 1877.

She was brought to the hospital with some difficulty, by reason of her exceeding weakness, and carried upstairs to the ward. She had no pain, no frequency of micturition, nor any local symptoms beyond the urinary change, which will be further adverted to. There were no enlarged glands, either in the inguinal region or elsewhere. The catamenial discharge had been very irregular, and absent since the preceding July. The tongue was clean, the bowels regular, the pulse 80, weak. Though a woman of ordinary stature and by no means small frame, she was found to weigh only 4 stone, 13 pounds, 2 ounces.

The urine for the twenty-four hours ending on June 28 measured 1,820 c.c., and had a specific gravity of 1011·3. It had the appearance of rich milk, save that, on pouring off the top, a few blood clots and some liquid blood were seen. The microscope showed abundant red and some white blood corpuscles. No oil globules were seen. The urine was opalescent, but no distinct molecular base could be detected, even under 900 diameters, so finely divided was the fat. There were some structureless shreds, which appeared to be fibrine, crystals of uric acid and oxalate of lime, and a number of large, globular, epithelial cells, mostly with conspicuous nuclei. (See woodcut, p. 1113.) No casts of the renal tubes could be detected. Before analysis the coagula were broken up, and the whole uniformly mixed: the blood was only enough to impart the faintest tinge of pink. It was found that, when the albumen was precipitated with heat and acid, the whole of the fat was retained in the coagulum, a circumstance which made the accurate estimation of this substance easy.

The following results were obtained for twenty-four hours:—

	Grammes.
Total solids, after evaporation	75·34
Fat (hard and yellow like bee's-wax, dissolved with ether from the albuminous coagulum) . .	16·926
Albumen + fibrine, the latter in very small quantity	24·388
Urea	15·47
Phosphoric acid	·637

Effect of abdominal pressure.

She was put on liberal diet, and on July 2 an attempt was made to arrest the discharge by mechanical means. To this end, I asked my colleague, Mr. Pick, to apply an abdominal tourniquet, so that the pad made pressure upon the front of the lower lumbar vertebræ, just above the sacral joint, in the hope of occluding the channels through which it was inferred that the chyle regurgitated from the thoracic duct to one of the urinary surfaces. This bore upon the abdomen about an inch below the umbilicus, and lessened, though it did not stop, the pulsation in the femoral arteries. The instrument, which had been put on shortly after dinner, was kept on for six hours, during which no food was taken, but a cup of tea. During the experiment the chylosity lessened and finally ceased. Some urine, passed just before the belt was removed, was clear, of a natural urinous yellow; instead of coagulating with heat and acid to one-half, which it had done before, it displayed with these tests only a slight cloudiness, and presented no other abnormity, save a small quantity of mucus, much oxalate of lime, and many round cells, such as were formerly observed. The urine, when evaporated and extracted with ether, gave only a trace of fatty matter. The girl was greatly elated at the restoration of the secretion to its natural appearance; she had passed none such since the beginning of her illness; and she gladly submitted to further attempts of the same kind.

Upon the removal of the belt the urine gradually resumed its former characters, and in sixteen hours was as before.

The experiment was repeated on July 6, in circumstances which clearly showed that want of food had no part in producing the alteration of secretion, which was apparently due only to the pressure. Water was passed at noon, which was milky as before, had a specific gravity of 1012, and with heat and acid became nearly solid, with the oleo-albuminous coagulum.

The belt was now put on. At 12·30 the patient took a meat dinner, at 4 tea, at 7·30 beef-tea and bread. At 1·40 A.M. the belt was removed. During the interval the chylosity of the urine lessened, and its specific gravity increased. At 9·15 the water was scarcely chylous; it was slightly turbid with lithates, on the solution of which, with gentle heat, it presented almost the colour of normal urine. It was still albuminous to one-fifth, and had a specific gravity of 1029. At 1·40 A.M., when the belt was removed, the urine had a normal yellow colour, though slightly turbid, displayed a little brownish deposit of blood, and coagulated, with heat and acid, to one-fourth. At 6 A.M. the urine solidified spontaneously into a jelly-like mass, in which were many blood clots. The pressure was repeated on most days, until July 18, always with results such as have been described, though with repetition they became less marked. It was now arranged that the tourniquet should be worn for each alternate twenty-four hours, which plan was continued until August 11. The urine during the application, more especially towards the close of the time, was always less milky than in the intermediate days, and often scarcely milky at all. The great diminution in the amount of urine under pressure, which was at first observed, ceased to be apparent, as also did the rise of specific gravity formerly noticed in the same circumstances. The fibrinous portion did not lessen, as did the fatty, for the urine often gelatinized when it had ceased to be milky.

Under the pressure which constituted the sole special treatment—though, no doubt, a liberal diet contributed to the beneficial result—she greatly improved in general health, lost her anæmic look, became cheerful and active, and increased her weight from 4 stone, 13 pounds, 2 ounces, to 7 stone, 9 pounds, 6 ounces. The chief inconveniences caused by the pressure were pain in the legs and slight œdema in the ankles.

The urine was examined again on July 25, when the tourniquet had been discontinued. It looked like the richest Alderney milk, and now presented, under the microscope, an abundant molecular base. The quantity for twenty-four hours was 1,817 c.c., specific gravity 1014.

The fat was estimated in two ways: 50 c.c. of urine were evaporated down and extracted with ether; this gave ·473 grammes of pale, oily, apparently pure, fat, not soluble in alcohol, ·099 soluble in alcohol, inseparable from traces of extract, the total thus being ·572. In the second process, which appeared to yield the fat more absolutely free from admixture, it was separated by ether from the albuminous coagulum; this for the same quantity of urine gave ·537 of fat, soft, oily, and homogeneous.

Giving the fat as the mean of the two processes, the amounts for twenty-four hours are:—

Fat	20·165
Albumen	24·315
Urea	21·8

August 3
Intercurrent febrile attack.

The course of the complaint was now varied by the intercurrence of a febrile attack of a kind which was several times repeated during her stay in the hospital. This resembled typhoid, which it was at first supposed to be, but it was shorter than the usual course of this disease, and was not attended with the special symptoms—spots and diarrhœa—which commonly attend it. The temperature gradually rose from normal, attained its highest point 105·5 on the seventh day, then gradually declined, and on the fifteenth was again normal. The urine during the attack entirely lost its milkiness, but remained fibrinous and sanguineous, often coagulating into a trembling pink translucent mass.

Effect of styptics by the mouth.

The fever left the patient much as it found her; the urine with her recovery resumed its former character. She now took in succession by the mouth, without any effect upon the chylosity of the urine, a series of drugs of the styptic class, including ergot, and gallic and tannic acids. The gallic acid was abundantly found in the urine, which was not otherwise altered.

On October 26, while under iron, the urine, which at that time was of a pale buff colour, evidently less chylous than formerly, was again examined. The specific gravity was 1014·4. The following results were obtained for twenty-four hours:—

Quantity	1,970 c.c.
Urea	29·5 grammes
Phosphoric acid	·443 ,,
Albumen	9·47 ,,
Fat	1·77 ,,

Vesical injection

On December 13, in the belief that the bladder was the place of the discharge, I determined to try the effect of astringent injections into this cavity, using a solution of the tincture of the perchloride of iron in water two drachms, gradually increased to four drachms, to twelve ounces, the mixture being injected into the empty bladder and retained for eight to twelve minutes with little or no inconvenience. This operation was repeated on most days until January 27. The results, especially at first, were striking; with repetition they became less marked, though they never ceased to be evident. The urine passed before the first injection was highly chylous, contained much blood, and albumen to one-half. The urine passed an hour after the injection was nearly normal in colour and transparency, and albuminous only to one-twelfth. On the discontinuance of the injection the tourniquet was again employed, but its pressure gave pain and was followed by an outbreak of herpes before and behind the left thigh, about the knee, and in the popliteal space. The pressure was therefore discontinued; it had not been productive of the

Abdominal pressure resumed. Subsequent herpes.

good effect which had been formerly observed; the urine, indeed, became more bloody under its influence. The injection was again resorted to, but soon discontinued, as the patient was suddenly attacked with rigors, restlessness, headache, and pain in the right lumbar region and small of the back, followed on the next day by pain in the right thigh, and slight œdema of the same leg. Feb. 19. Injection resumed.

The temperature remained at fever height for eight days, its maximum being 105·5. She was frequently sick, and under the attack exchanged a rosy look which she had previously had for one of extreme pallor. The urine now became more bloody and less chylous, then ceased to be bloody, and in three days was natural. By this time the pain in the back and in the leg, together with the œdema, had gone, though the patient still complained of headache and pain in the neck, which soon gave place to stiffness, which in its turn disappeared to leave her quit of the intercurrent attack and at least for a time of the chyluria. March 2, 1878. The urine after some days became again albuminous, though only to a slight extent, and once or twice slightly chylous, but the latter condition did not recur after March 4 until the following June; the albumen by the 15th was reduced to a trace, and after the 22nd none was to be found. The urine, after the apparent restoration of its normal state, still presented under the microscope a large number of epithelial cells of large size and various shapes, some of which were like those represented in the woodcut (p. 1113). The urine was drawn off with the catheter so as to preclude the possibility of vaginal admixture. It is to be stated that at this April 2. period two hyaline casts of the kidney tubes were once found, an experience which was never repeated, notwithstanding the frequent examinations which were made, and which was probably to be attributed to some accidental cause. The patient was now well, perfectly free from all special symptoms, stout and full-coloured, and of the weight of 9 stone, 6 pounds, 8 ounces. In April 10. this state she left the hospital, but in the following month, while she was under the influence of a severe cold, the urine again became milky, and on the 19th she returned. Second admission, June 19, 1878.

Her general health had not much suffered; the menses had been regular, and but for the appearance of the urine she would not have supposed herself ill. This was milky, blood tinged, and highly albuminous, but not constantly so, for on several isolated days, and once for three days continuously, it presented the characters of health.

Injection resumed.

On July 16, the urine being then continuously milky, the injections of iron were recommenced in the strength of four drachms of the tincture of the perchloride, gradually increased to eight, to twelve ounces of water. The strongest was generally retained for about an hour; the weaker for longer. The operation was repeated daily, except during the catamenia, until August 9, when she complained of much pain in the back and had to stay in bed. The morbid admixture had lessened, often obviously with each injection, so that when upon the occurrence of the pain the treatment was discontinued, the urine was natural in all respects save that it contained a trace of albumen. The pain in the back had been accompanied with some elevation of temperature (101°), but by the 27th she was convalescent and without any recurrence of the chyluria. She left apparently well on September 4.

Third admission, Feb. 12, 1879.

Again injected.

The urine remained natural, according to her statement, for about a fortnight after her leaving, and then after a long walk became chylous again. She was treated as an out-patient, chiefly with iron and tannic acid by the mouth, latterly injeetions being given also at long and irregular intervals. She did not materially improve, and again in the following February she was received into the hospital. The urine was highly chylous and bloody and herself anæmic, black under the eyes, and suffering from headache and depression. The injections were resumed on the 26th and continued daily, except at the menstrual periods, until April 8. Five drachms of the tincture of the perchloride with ten ounces of water were generally retained for three-quarters of an hour, sometimes for twice that time. Without daily detail it will suffice to say that the urine, which before the injections were begun looked like tea with a good deal of milk in it, contained much blood, and coagulated with heat and acid to three-fourths, gradually resumed under their influence its natural condition.

A change for the better was immediate after each of the earlier injections. Later the improvement was continued more or less in the intervals, until on April 4 the secretion both before and after the injection was perfectly natural, clear, yellow and free from albumen. These characters were retained and the treatment discontinued on the 8th.

I am indebted to Mr. Bartolacci for the following analyses, which will show the variations in composition which the urine underwent during this course of treatment.

Urine passed before the injections were begun.

Date	Quantity		Reaction	Specific Gravity	CH_4N_2O		Phosphates as P_2O_5		Chlorides as NaCl		Albumen		Fat	
	oz.	c.c.			Total Gms.	Gms. per 100 c.c.	Total Gms.	Gms. per 100 c.c.	Total Gms.	Gms. per 100 c.c.	Total Gms.	Gms. per 100 c.c.	Total Gms.	Gms. per 100 c.c.
February 17 .	40	1135·84	Feebly acid	1015	13·064	1·15	1·562	0·1375	6·248	0·5661	16·267	1·41	7·378	0·649
February 24 .	40	1135·84	Acid	1015	13·632	1·2	1·42	0·1251	7·952	0·7	16·288	1·434	6·2165	0·557

Results of two Analyses of the Urine while the injections were in use—viz. that passed from early morning to the time the Bladder was injected with perchloride of iron at midday; and that passed after the injection was voided to late at night, the whole being equal to that for the twenty-four hours.

March 28	Quantity		Reaction	Specific Gravity	CH_4N_2O		Phosphates, P_2O_5		Chlorides as NaCl		Albumen		Fat	
	oz.	c.c.			Total Gms.	Gms. per 100 c.c.	Total Gms.	Gms. per 100 c.c.	Total Gms.	Gms. per 100 c.c.	Total Gms.	Gms. per 100 c.c.	Total Gms.	Gms. per 100 c.c.
Before Injection .	8·98	250	Strongly acid	1017	3·25	1·3	0·4145	0·165	2·084	0·84	0·9065	0.3626	0·1773	0·0709
After Injection .	11·445	325	Moderately acid	1016 1018	4·55	1·41	0·569	0·175	2·167	0·667	0·7868	0·242	0·1562	0·048
For the twenty-four hours .	20·425	575	—	1017	7·8	1·362	0·9835	0·1706	4·251	0·7422	1·6933	0·294	0·3335	0·058

Some urine which was passed on March 29, before injection on that day, gave the following results: for 100 c.c., albumen ·0895 grammes; fat ·0193 grammes. The observations are sufficiently distinct as showing the diminution of albumen and fat under the continuance of the process.

April 10. She had increased nearly a stone in weight; weighing when she went out 10 stone, 9 pounds, 2 ounces, and possessing the full colour and rounded form of perfect health.

About the 3rd or 4th of the following June, while at her own home working as a dressmaker, the urine again, without any recognisable cause, became chylous. Her health did not at first suffer, and she did not return to the hospital until the following October. On the 16th the injection was resumed, but soon suspended during menstruation, and on the 31st finally discontinued in consequence of the appearance of a vascular excrescence about the orifice of the urethra, which made the introduction of the catheter painful, and was associated with intolerance of the solution in the bladder. She had liberal diet, iron, quinine and cod-liver oil, and on this treatment improved much in general health and left the hospital on December 15, with the urine still chylous as it had been during the whole of her stay on this occasion. At the early part of the period she had suffered much from headache, and had had a passing attack of congestion of the lungs, with general crepitation and much viscid expectoration.

Fourth admission, October 15, 1879.

Out of the hospital the patient was still kept under cod-liver oil, iron and quinine, and for about seven months continued in good general health, though the urine never failed to be chylous. After this time, however, she suffered much from headache, chiefly occipital, nausea, and loss of flesh and strength, and was again admitted. Another attempt was made to administer the injections which had before proved so useful; these were at once beneficial in reducing the chylous matter in the urine, but after nine daily administrations they had to be discontinued in consequence of the severe pain to which they gave rise. On December 12 she was discharged with the chyluria unaltered, though she had much improved constitutionally under good living and tonics.

Fifth admission, October 13, 1880.

The urine remained chylous after her dismissal, and in the following June she presented herself in a state of extreme anæmia, and so much exhausted that she was retained in the hospital though she had come with no intention of remaining, as it was feared that were she to leave to return next day, as she proposed,

Sixth admission, June 27, 1881.

she might faint by the way. Upon admission she passed a large quantity of highly chylous urine which had a reddish-grey colour, contained pale red clots, and had the odour of milk. It was alkaline, had a specific gravity of 1010, and coagulated with heat and acid to one-half. On subsequent occasions it frequently coagulated in the chamber vessel into a gelatinous mass. The patient was kept at rest, liberally fed with strong beef-tea, milk and brandy, treated with cod-liver oil and the ammonio-citrate of iron, fifteen grains three times a day. She at first suffered much from headache, but soon ceased to do so, and rapidly improved in colour, flesh, and strength. The character of the urine remained much the same, though the proportions of blood and chylous matter varied from time to time. On one occasion recourse was had to the injection, but it was expelled in two or three minutes and left so much vesical pain that no further attempt was made in this direction. Urine passed immediately before the injection was highly chylous, like milk, opaque, contained much blood, and coagulated with heat and acid to two-fifths. Urine passed an hour after the injection was transparent and nearly natural; to the eye it would have passed as such save that the colour had a shade of pink in it. It coagulated with heat and acid to a quarter. Next day it was chylous as before. After about two months' stay she went out able to resume her occupation, though with the chyluria persisting.

Aug. 18. Final discontinuance of the injection.

She continued to take some form of iron out of the hospital, but had ceased to do so when without any ostensible cause the urine became normal in appearance. The girl often came to the hospital to show herself; she appeared to be in perfect health; the urine examined from time to time was perfectly natural, or displayed only a faint albuminous line with acid in the cold. In the following summer she married. I frequently saw her afterwards in perfect health, but in August 1883 I received another visit from her, and the intelligence that six weeks previously the urine had again become pink though not milky. She was apparently perfectly well in general health, and weighed 9 stone, 13 pounds. Some urine passed on that day was faintly pink; it became almost gelatinous and gave a coagulum with heat and acid amounting to one-half.

January 1882. Spontaneous suspension of the chyluria.

August 17, 1883.

The foregoing narrative needs little comment. Filariæ were perseveringly sought but never found, either in the blood or the urine. Blood was repeatedly taken from the finger both by night

Comments.

and day, and the urine was frequently examined with especial reference to the clots.

The urine varied much as to the form and amount of the fat; sometimes though abundant it was so finely divided as not to be appreciable with the microscope, excepting as indefinite opalescence. At other times it presented a distinct molecular form, and once or twice oil globules were seen. A point of interest with regard to the secretion was the never-failing occurrence of the large globular epithelial cells which have been represented. That these belonged to the urinary passages and not to the chyle was sufficiently shown by their persistence when the discharge was absent. They were not vaginal, for they were found in the urine obtained with the catheter. If vesical, as they appear to be (see 'Outlines of Urinary Epithelium,' p. 665), they give an important hint as to the place of the discharge. The effect of vesical injection was no less suggestive. That the chyluria was immediately, though perhaps only temporarily, modified by perchloride of iron thus introduced admitted of no doubt. It could scarcely be that the injection entered the ureter; the result can be assigned only to its action upon the mucous membrane of the bladder.

On one or two occasions the suspension of the discharge under this process was followed by pain in the loins, possibly from some ascending irritation, but this was not constant and perhaps may be regarded as accidental or collateral.

The effect of pressure is conclusive as to the mechanical origin of the discharge, but not so as to the position of the leak. No radical or permanent effect could be very confidently expected from the local measures which were adopted, however beneficial they were in suspending the waste. The good results of measures of compensation, liberal diet, cod-liver oil and iron, were apparent. Mere astringents, gallic acid, and ergot were of no avail. As in other cases of the disease it had a variation independently of medicine, going and returning in a way that appeared capricious. It was noticeable that, at the outset of the disease and some of its recurrences, the patient had apparently caught cold. Exercise also made it worse. The temperature was generally such as would pass for natural, ranging between 97·5 and 99·5. There were occasional febrile exacerbations, in which it was for a time much higher. With that in August 1877 the temperature rose to 105·5, and in that in the following

February to the same maximum. There were in the course of the disease a few lesser febrile attacks lasting sometimes one day, sometimes two or three days, but for long periods the temperature kept within the range which has been stated.[1]

Chyluria which began in England five years after the patient had left India.

Mrs. E—— was born in India of English parents, and lived in Calcutta until twelve years old. She then came to England, returned to India at the age of seventeen, married at nineteen, and lived in Calcutta until she was twenty-nine. She was then sent to England in consequence of weakness after child-bearing, and returned to India no more. In the year 1867, when she had been five years in England, at Southsea, she observed for the first time that the urine was white like milk, but it so remained only for a few days. This occurred two or three days after she had received news of the death of her husband, and she thought it was brought on by the shock. She was the mother of four children, the last born at Southsea in 1864.

After several transient recurrences, in which nothing was noticed save the altered appearance of the urine and that it was passed frequently, the complaint, in December 1876, recommenced in a more lasting form. She was then at Bedford, under the care of Dr. Goldsmith, by whom, on April 15, 1878, she was sent to me.

April 15, 1878.

She was then pale as she habitually was. She had become weaker than formerly, though still able to walk four miles. She had a slight cough which she had had all the winter, with slight mucous expectoration. The apices were natural. She had never spat blood. There was no œdema. The bowels were much confined, the appetite not good, the tongue coated, the pulse quick, 116. The catamenia were regular, but were always preceded by an attack of sick headache, pain over the left eyebrow, watering of the eye, and vomiting. This constituted her chief complaint. Apart from the state of the urine she had no symptoms especially referable to her disorder, excepting frequency of micturition, which took place about every hour during the day and once in the night. There was no pain or tenderness in the bladder or loins. Blood from the finger was repeatedly examined for filariæ, but none found. I had no opportunity of obtaining any at night.

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[1] This case was briefly related to the Pathological Society on November 4, 1877 (see *Trans.*, vol. xxix.), in support of the hypothesis of the mechanical regurgitation of chyle. I then ventured to attribute the disease to obstruction of the thoracic duct, either by the minute filariæ or by an, as yet, undiscovered parent worm. The parent had already been found by Dr. Bancroft, though I was not then aware of the fact.

The urine was described as almost always milky, though occasionally for a single micturition it was clear. It usually presented a creamy surface after standing, and frequently had a pink tinge. No difference was observed in connection with food or between that passed by day and by night. Some which I received looked like the richest milk, and had a faint milky smell. Upon pouring off the white superstratum many gelatinous shreds were seen in the lower part which were streaked with blood. The fluid was faintly acid and had a specific gravity of 1018. The following estimations were made for 100 c.c. :—

Urea	1·7
Phosphoric acid	·325
Albumen	1·771
Fat	1·632

The fat, when cold, was like bee's-wax; it readily fused into an uniform bright yellow oil.

As to the microscopic appearances, putting together observations made on several different occasions, the creamy top of the fluid sometimes showed large and distinct oil globules. The milky liquid sometimes was merely nebulous, displaying no molecules with 900 diameters; at other times it showed an abundant granulation, or fine stippling, which was sometimes uniformly spread, sometimes irregularly aggregated. The woodcuts at page 1110 represent these appearances as observed on May 23. Ether at once destroyed the milkiness and the granulation; upon the removal of which reagent by evaporation the delicate stippling was replaced by ordinary, though minute, oil globules. The urine seldom failed to display a number of the large, rounded, epithelial cells, some of which are represented on page 1114, which appear to be constant with chyluria. Besides these were flat scales, apparently from the vagina, blood corpuscles, and occasionally bacteria. No casts were ever seen, nor any filariæ.

April 15. I advised her to live well, to take a quarter of a pint of cream daily—she could not stomach cod-liver oil—and ten grains

May 23. of the ammonio-citrate of iron three times a day. In six weeks she had gained weight, improved in colour, had had less headache, and during three days had passed urine apparently natural. This, however, remained for the most part as chylous as ever, and so continued under gallic acid, and later under tannic acid and perchloride of iron in alternate doses. No lasting improvement was gained, the astringents by the mouth were discontinued, and the injection into the bladder of the perchloride proposed. But before this was executed I received a letter to say Dec. that the discharge had spontaneously ceased, and had remained absent for five weeks.

CHAPTER XX.

INTERMITTENT HÆMATURIA OR HÆMOGLOBINURIA.

Designations.

The disorder originally described as intermittent hæmaturia has of late become possessed of additional titles. Sir William Gull proposed to substitute the term *hæmatinuria* for that previously in use in assertion that hæmatin rather than blood in its entirety was introduced into the urine. It has since been shown, however, that the characteristic discharge is hæmoglobin rather than hæmatin, and the name correspondingly changed to hæmoglobinuria, the term now in most frequent use. It is clear, however, that most if not all the constituents of blood, whether in shape or in substance, are discharged by the kidneys in this disease. Fibrin and albumen are certainly present: the former both in casts and otherwise; and albumen is to be detected independently of the corpuscular products and after they have ceased to appear. Perhaps, therefore, we may remain content with the oldest substantive by which the hæmorrhage has been designated. Dr. Pavy has sought to replace the adjective Intermittent by Paroxysmal as better suited to describe the irregular recurrence of the attacks, and more recently terms have been introduced, as Winter Hæmaturia, Hæmoglobinuria a Frigore, or From Cold, in assertion of the general exciting cause of the attacks. But in both respects I prefer the original distinction. Intermission does not necessarily imply periodicity; a disorder may intermit irregularly and in obedience to external circumstances; ague itself may return capriciously, not according to date but according to weather; and using the term intermittent thus widely, it would seem to be especially suited to the disorder in question, since it is to be distinctly reckoned among the results of the marsh poison. The terms which refer to cold as the cause of the fits are descriptive of one character of the disease, but the older qualification has also a special appropriateness which cannot with advantage be lost sight of.

General characters.

The disorder is one of remarkably definite characters. The patient, one frequently who has had ague or been exposed to malaria, is attacked sometimes periodically, but more often after chance exposure to cold, with rigors like those of ague, speedily followed by the passing of urine, which to rough observation would seem to contain blood, but in which the corpuscles are replaced by a pulverulent sediment either loosely scattered or more or less shaped by the kidney-tubes. With warmth the shivering ceases; the urine slowly resumes its natural character, and the patient remains free both from the shivering and the hæmaturia until, as happens in the majority of cases, an accidental chill, or as is the manner with some, the recurrence of the period, brings a repetition of the process. Occasionally with the attacks the skin assumes a yellow tint like that of slight jaundice. With this as the outline of a typical case, I will proceed to fill in from my own observation and that of others such details as have as yet been brought within our view.

Early references to the condition.

Prout as early as the year 1825[1] alludes to an instance of obstinate hæmaturia in which the bleeding was constantly preceded by a shivering fit. In the later editions of his work[2] he enlarges upon malaria as a cause of this form of hæmorrhage, dwells upon 'the multiform degrees and shapes assumed by this fearful scourge,' as making it difficult justly to estimate its effect, and discusses the treatment of 'hæmaturia decidedly connected with affections of malarious origin,' recommending the mineral acids, quinine, and perchloride of iron.

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[1] *An Inquiry into the Nature and Treatment of Diabetes, Calculus, etc.*, 2nd edit., p. 299.

[2] *On Stomach and Urinary Diseases*, 3rd edit. 1840, pp. 432 and 437.

In the meanwhile the subject had attracted the notice of others. Dr. Elliotson[1] described a case of irregular ague which had been contracted in the Walcheren expedition, in which he mentions as a peculiarity unexampled in his experience that with every cold fit the urine became bloody. There were also symptoms which were held to indicate hypertrophy of the heart, but the bloody urine, says Dr. Elliotson, was intermitting like the rigors, and was thought to belong to the ague, not to the cardiac disturbance. The patient recovered under quinine.

In the year 1837, Gergerés[2] reported a similar case as one of quotidian hæmaturia. A naval captain had fits, apparently of severe ague, in which he passed blood instead of urine. These attacks recurred at the same hour for three successive days, and they were cured by large doses of quinine. More recently the conjunction of aguish symptoms with hæmaturia was referred to by Sir Thomas Watson,[3] with the mention of a case within his own experience in which this discharge was always marked by a smart rigor.

Details have since been added to these broad observations, of which the most important is the distinction between the intermittent and common hæmaturia in the absence of blood-corpuscles in the discharge belonging to the former; and attention has lately been drawn by Dr. Wickham Legg[4] to a paper by Dressler,[5] published in the year 1854, which had hitherto escaped notice, in which this and other particulars of the disorder were pointed out and the names Intermittent Albuminuria and Chromaturia employed.

More recently fresh attention was drawn to the subject by two papers which were read on the same evening

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[1] *Lancet*, 1832, vol. i. p. 500.

[2] *Gazette Médicale de Paris*, 1838, p. 151. Quoted from *Journal de Société Royale de Médecine de Bordeaux*.

[3] *Lectures on the Principles and Practice of Physic*, 4th edit., vol. ii. p. 725.

[4] See Paper on *Paroxysmal Hæmaturia*, by Dr. Wickham Legg, Bartholomew Hospital Reports for 1874.

[5] *Dressler, Arch. f. Path. Anat.*, 1854.

More recent descriptions and sources of information.

at the Medico-Chirurgical Society (May 9, 1865). The first read and first contributed was by Dr. George Harley, the second by myself. These recorded, with microscopic details not hitherto attainable, cases which had been observed independently. The attention thus drawn to the curious particulars of the disease was followed by the publication of many instances which at this date it is not necessary to enumerate, but of which a list up to the year 1874 may be found in Dr. Wickham Legg's paper to which I have referred. My own experience, besides fragmentary observations, is represented by 21 cases, of which I have tolerably complete notes, and in which the nature of the complaint was beyond doubt, though in two of them I did not see the urine under the paroxysm. I shall appeal to these as presenting facts for which I can vouch, and experience which is for the most part unrecorded.

Subjects and antecedents.

First as regards sex and age: of my 21 cases 15 related to males, 6 to females. In age the subjects when brought under notice varied from 3 to 48 years. 4 were between 3 and 5 years of age; one 9; one 16; one 19. Afterwards the disorder was distributed between the ages of 25 and 48 without great inequality. The earliest age at which the disease has been observed, according to Dr. Legg's enquiry, is 2 years; the latest at which it has been known to commence, 52.

Malaria.

Next as to the antecedents of the disease and of its attacks. As preceding the liability, the influence of malaria is to be traced more often than any other, though by no means always; while cold with much constancy is the excitant of the attacks. As to malaria, careful enquiry among the 21 cases I have referred to gives the following results. In 3 there had been tertian ague. In 2 there had been fever, which was described as of malarial origin, but which was less exactly defined. As to the 16 cases in which no intermittent or malarial fever had been recognised, they were thus circumstanced as regards the marsh poison. Two patients had formerly lived in house-holds other members of which had had ague; one with a brother at Waltham Abbey, who died with it; one in a village near Tunbridge where two uncles had it. Three had lived or worked where there was evidence or suspicion of malaria of a less direct kind; one at Barking in Essex; another used to go harvesting to the Essex marshes, and sleep in a barn. And I have made especial mention (p. 1217) of the case of a man who was attacked with the disease, and apparently contracted it, while digging foundations at Charing Cross in the ancient bed of the Thames. It is notorious that newly exposed soil in a malarious district is especially dangerous. Beside these instances in which a malarial influence may be regarded as ascertained, there are others in which it may be suspected. Five came from the immediate vicinity of the Thames in Westminster, Pimlico, Bermondsey, and Oxford. Two came from Haverstock Hill, where, according to the testimony of one of them, ague was known. I have ascertained, however, from Dr. Coffin, who practises in that neighbourhood, that though there have undoubtedly been cases of ague there they have apparently all been imported. Putting aside, therefore, the Haverstock Hill cases, but including those from the banks of the Thames, there are out of the 21 cases 15 in which there had been a history of ague or a probability of exposure to malaria. I may mention in connection with this origin of the disease that a late physician who suffered from the disorder but did not consider it to have had this source, was born at Hythe in Kent, where ague was, and probably is, well known.

I have preferred to appeal to cases which I have myself enquired into with this end in view, but I might adduce evidence to the same purport from other sources. I find that among 22 published instances taken without selection ague is mentioned as an antecedent in 6. But I think it is clear that the precedence, often remote, of malaria must be admitted in many cases where ague has not been definitely declared. In some cases the malarial fever, as in the case of Catherine Evans (p. 1192) has been accompanied or immediately succeeded by the hæmaturia, but more often there has been an interval between the two affections, in one of my patients, one of 3 years, in another of 9 years, in a third of 14 years. In one instance mentioned by Dr. Harley a West Indian Intermittent had not subsided when the hæmaturia commenced; one of Dr. Roberts' patients who had repeatedly had ague, also in the West Indies, lost it two years before the later complaint declared itself. The disease, also, as has been made sufficiently clear, may ensue upon malarial exposure without the intervention of anything that can be recognised as ague. We have evidence in those cases where the hæmaturia has immediately succeeded upon ague that malaria is able by itself to set up the condition in question, while in others, and those the more frequent, this agency presents itself rather as a predisposing than the exciting cause. But it is present in one guise or another so frequently that considering the tenacity of the malarial influence, its insidious and often latent character, and the certainty that it is often present where it cannot be traced, it must be allowed, that this is, to say the least, the most frequent of the causes to which, whether predisposing or exciting, this peculiar form of hæmaturia is to be attributed.

Heredity.

The disease presents itself almost invariably without any suspicion of heredity. It has been known, at least in one instance, to occur in two generations—a young man had hæmoglobinuria and much enlargement of the spleen,[1] his sister presented traces of hæmoglobin in the urine, but had no enlargement of the spleen. Their father had passed dark urine and died with a spleen weighing 7 pounds. The organic enlargement in father and son would at least suggest the possibility that both may have been malarial, and the disease endemic rather than hereditary.

Injury and exertion.

Instances have been reported in which violence or exertion have appeared to be concerned in the production of the disease. Sir W. Gull mentions that of a young lady in which the peculiar condition of urine followed an injury to the back in a fall in getting into a railway carriage. Rosenbach has reported a case in which the first attack succeeded upon a fall from a waggon, though recurrences were induced by exposure to cold. A case is recorded by Fleischer in which hæmoglobinuria, unaccompanied by shivering or sweating, appeared in a soldier first after a long march, and recurred as the result of walking, not from stationary exercise or from cold.

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[1] Case of continued Hæmoglobinuria, apparently hereditary, by Dr. Saundby, *Med. Times*, May 1, 1880, p. 176.

Syphilis.

Among the other antecedents of the disease which require mention are syphilis and alcoholism, but it is to be questioned whether either is really concerned in its production. Among my 21 cases, mostly men of the hospital class, there was evidence of syphilis in 6, perhaps not more than might in any circumstances have been reckoned upon. As to alcohol, it presented itself apparently as the exciting cause in two cases, in one of which the disorder presented itself during a debauch; in the other the bloody urine was said to have been first passed immediately after intoxication. In one of these there was no malarial history; in the other there had been malarial exposure but no ague. In both there had been syphilis.

Alcohol.

Suppuration.

In one or two instances hæmoglobinuria has succeeded immediately or remotely upon suppurative conditions, as in the cases of Dare and Madden, pages 1208 and 1216, and in one related by Dr. Wilks, and referred to at page 1186, in which this condition of urine was associated with symmetrical gangrene. One of these patients had come from a malarial district; hæmoglobinuria does not present itself with the lardaceous state so common a result of suppuration; and it may be doubted whether the evidence is sufficient to connect this process with the disease in question.

Cold and periodicity.

The excitant of each attack is generally cold; but the actual cause of the disease must be sought in the circumstances which have rendered the subject of it liable to be thus peculiarly influenced by an agency which commonly produces no such result. Cold with intermittent hæmaturia appears to stand in the place which time occupies with regard to ague; it does not cause the disease, but determines the paroxysm.

The influence of cold in this respect is one of the most striking characteristics of the disease. The patient is well so long as he is warm. The fit beginning with rigors is, as a rule, produced immediately by a chill; among our modern instances, however, where the description is minute and conclusive, there is at least one instance, that of Dr. Druitt, where the disorder occurred diurnally, and by the older writers such hæmorrhagic attacks are frequently spoken of as periodic.

The cold by which the sequence of symptoms is started is usually applied in some obvious manner, and is productive of a distinct sense of chill. A labourer is habitually attacked as soon as he goes out on a very cold or frosty day. The same man, though commonly exempt in the summer, once brought on an attack in warm weather by cleaning windows with cold water. A greengrocer attributed an attack to his having been for several hours on a cold day in an open shop; a laundress, hers to standing all day in a damp wash-house. An excursion into the country in an open cart instigated a seizure in another instance. A sailor who had many years before had ague in Havannah was first affected by the hæmorrhagic disorder during seven days of exposure after shipwreck. Some persons, however, have become so susceptible in this respect that waiting in a cold out-patient room, exposure to a chance draught, leaving bed in an attempt at convalescence, drinking, or washing the hands in, cold water, have been sufficient to re-initiate the morbid series.

Character of attack.

Thus started, a fit follows which might be taken for one of ague with, however, the distinguishing peculiarity that it is succeeded by the discharge of urine which contains the substance of blood, and displays its colour but not its shapes. As typical of the commencement and course of the seizure, I may adduce the habitual experience of a man whose case I brought before the Medical and Chirurgical

Society. He would get up and go to his work as a builder's labourer apparently well. If he happened to get chilled he would very shortly be attacked with shivering and retching, together with yawning and an inclination to stretch himself, pain in the loins and down the thighs, and retraction of the testicles. Within an hour or so he would pass a considerable quantity of black urine, and the pain in the loins, up to this time on the increase, would gradually subside, and the constitutional disturbance cease. When the attack came on he used to leave his work and go home and to bed, taking care to be very warm. The urine usually retained its character for two or three times of passing and then resumed its natural appearance. The attack varied in length from 3 to 12 hours. It was often succeeded in the evening by griping or colicky pain about the umbilicus. Next day weakness and pallor were the only remnants of the attack, and upon recovery from these he remained without ailment until after an uncertain interval the process was repeated.

In the larger number of instances the sanguineous discharge has ceased after two or three emptyings of the bladder, or even with one, the whole attack being comprised within the period of 24 hours. In others the hæmorrhage has continued for several days, with little alteration, as in the cases of Rose Baker and John Dare, and others presently related. (See pages 1205, 1208, and 1216.)

It has frequently been observed that under the attack the patient has become jaundiced or yellow. It is probable, however, that the discolouration has nothing to do with the secretion of bile, but is a tinting of the skin by the hæmatine which is set free. And not only may hæmatine be thus generally diffused, but local hæmorrhages have been known to occur in the shape of purpura, and there is at least clinical reason to suppose that effusions of blood or of some of its material sometimes take place into the joints or cellular tissue. (See cases of Catherine Evans, page 1194, and Rose Baker, page 1206.)

When beginning with a marked rigor, yawning, retraction of the testicles, and pain in the loins and thighs are seldom wanting. The attacks are most apt to come on in the early part of the day, though they do not invariably do so. A patient assured me that he could bear in the evening with impunity an exposure which in the morning would never fail to bring on an attack. In some cases the coldness and lividity of the extremities, or of the nose or cheeks, in the beginning of the attack, have been almost as if the parts were about to mortify. Dr. Druitt describes his face as spotted with blue like patches of incipient gangrene. And it has been observed, from whichever point of view we regard the concurrence, that together with the attacks of local coldness and arrest of circulation followed by symmetrical gangrene, and described by Reynaud, hæmoglobinuria has occurred.

When repeated in a severe form the patient is apt to become pallid from loss of blood, or may present a yellowish or earthy complexion. Loss of sexual power has been noted, as in a case reported by Mr. Neale.[1]

Urticaria sometimes appears in connection with the disease. Edward Harvey (page 1212) frequently had attacks of this upon the arms on their first exposure to cold when he got up in the morning, and Dr. Forrest[2] has recorded an instance in which a sufferer from hæmoglobinuria often had patches of the same nature after washing in cold water or exposure to rain or a cold wind. The concurrence has been held to indicate a nervous origin for the urinary disorder, and from another point of view may be taken to associate it with ague and with Reynaud's disease, in connection with both of which this eruption has been known to present itself.

Abortive attacks.

The attacks vary in degree from severe rigor and profuse hæmorrhage to a transient chilliness, succeeded by urine which is merely lithatic or but slightly discoloured. Even with the slighter forms, however, the complexion may be yellowish, sallow, or earthy. Such abortive attacks, in which there is no rigor but only an approach to one, and in which the urine becomes only lithatic, often present themselves in the place of the more complete fits when the complaint is on the decline; and possibly such mutilated symptoms may be the only evidence of the disease in an obscure form in which it sometimes presents itself.

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[1] *Lancet*, Nov. 1879, p. 725.

[2] *Glasgow Med. Journal*, 1879.

Temperature of body.

The range of temperature under the attack is generally lower than that of ague, and the fluctuation smaller, though some instances have been recorded in which both in level and variation the hæmaturic chart has closely resembled that of the more common intermittent. With a fit of ordinary ague the temperature begins to rise, as the first intimation that the cold fit is beginning, and continues to mount until the sweating period, when it descends rapidly. With intermittent hæmaturia it has frequently been noted that the temperature is lower than normal in the cold stage, and the elevation on its termination small or unobservable.

In Dr. Harley's case, the temperature in the axilla during the cold stage was 96·1°. In one recorded by Dr. Roberts, the thermometer in the same situation, at the same period of the attack, marked 96·6°; a few minutes afterwards the patient passed bloody urine, and five minutes later said he felt quite well, and displayed a temperature of 98·6°. Dr. Druitt (see p. 1230), after a statement of the large variations which he underwent in some paroxysms of apparently ordinary ague with which his disorder was complicated, remarks that, with these exceptions, the temperature of the mouth and axilla were steadily 98·4°; and as another instance in which the recurrences of the complaint were unattended with appreciable rise, I may instance that of Rose Baker, related at p. 1205. Thus, in some cases, unlike what occurs in ague, it is clear that the cold stage is one of actual coldness, while in others there is at least no abnormal heat.

Other examples, however, present more of the aguish character in this respect. One of Dr. Greenhow's patients gave under the rigor on three occasions temperatures which varied from 100° to 100·4°; while after the rigor it was once found to have reached 103·2°. Added to this, the attack has in several instances been succeeded by profuse sweating, so that at least sometimes the pyrexial character of the hæmaturic paroxysm has been marked and the resemblance to ague obvious. I have inserted at p. 1214, in connection with the case of Edward Harvey, a chart, in which the febrile character is declared by a temperature which mounted to over 105°. It is not improbable that in all attacks which are sufficiently acute to be attended with a cold stage, the temperature, however low at first, must rise as the fit goes on, and so present some sort of parallelism to that of ague, however much lower may be the general level of the curve and less marked the fluctuations. It is worth noting that in two of the cases presently recorded—those of Dare and Dr. Druitt—venous coagula were formed in the limbs.

Thrombosis.

Intercurrent and consequent diseases.

Other disorders may attack the subjects of this disease and run their course independently of it; instances are annexed in which diphtheria, quinsy, and measles have thus presented themselves, the last with a fatal issue; pneumonia, in one case, came on while the patient was in the hospital, as if connected in some way with the disease or its treatment; and it is to be observed that this disease was the immediate cause of the death of Dr. Druitt, though not obviously connected with the hæmoglobinuria. Perhaps the only disorder to be traced as a direct result of that condition is nephritis, of which association more than one instance is here recorded.

Urine.

To comprise in a few sentences what is known of the condition of the urine in this disorder, the secretion in the intervals of the attack is absolutely natural. With the attack it suddenly assumes a colour which is ostensibly due to the admixture of blood, though the range of tints, however deep, is rather vinous than red, smoky or black, as with other forms of hæmaturia. The urine is, on standing, divisible into two portions, a bright superstratum, perhaps of the colour of port or burgundy, or of the lighter tint of brown sherry or Madeira. This is coagulable with heat and acid to a greater or less extent, usually giving a dark brown floating clot in which most of the colouring matter is comprised. The coagulum produced by heat is sometimes, but by no means constantly, largely dissolved by nitric acid. The solubility of albumen in nitric acid admits of great variation. Paraglobulin, as estimated by precipitation with sulphate of magnesia, is usually present, though in much smaller quantity than the albumen (see cases of King and Collingbourne). After the urine has resumed a natural, or nearly natural, appearance, the guaiacum test will often give the blue.

Spectroscopically.

Many observations with the spectroscope have been made of late upon urine under the peculiar form of hæmorrhage in question. Hæmoglobin or oxyhæmoglobin has been always found together with, in some instances, methæmoglobin. In the urine of Taylor under an attack (p. 1218) Dr. Stone found the double absorption band of oxydised hæmoglobin. Drs. Forrest and Finlayson in similar cases found similar evidence together with that of methæmoglobin or acid hæmatin; and we have much other testimony to the same purport—hæmoglobin being constant and methæmoglobin occasional.[1] I have of late habitually examined specimens of urine under this disease with a large pocket spectroscope recommended by Mr. Browning for the purpose. Oxyhæmoglobin has never failed to present itself when the blood was fairly abundant. I have not recognised methæmoglobin. The spectroscope as a test for blood, whether corpuscular or disintegrated, appears to be inferior in delicacy to others.

Microscopically.

The sediment examined with the microscope consists of two components: first, a translucent filmy expanse, which has no more structure than the non-corpuscular basis of mucus, or the fibrinous shape which belongs to the most delicate form of tube-casts; secondly, granules which the first imbeds. The web is soluble in potash and acetic acid, and probably consists of coagulated fibrine. The granules entangled in it may be too small for recognition, excepting as a fine brown powder; but in many instances this is mixed with crystalline or crystalloid masses of a yellow colour, closely resembling the blood-crystals often found in the pia mater and elsewhere. Frequently, where no crystalline shapes are to be discovered, much of the deposit presents itself as sparkling granules, which are suggestive of crystalline structure, though too small to be identified. In two of the cases I have referred to as under my own observation distinct crystals or crystalloid particles were found; in four refracting specks, possibly of the same nature. The larger masses as seen under the eighth were distinct, strongly yellow and translucent, obviously blood-crystals, though generally irregular or rounded in outline. In one well-marked instance I found them to be soluble in liquor potassæ, not in acetic acid, as would be the case did they consist of hæmin or oxy-hæmoglobin. Taking their

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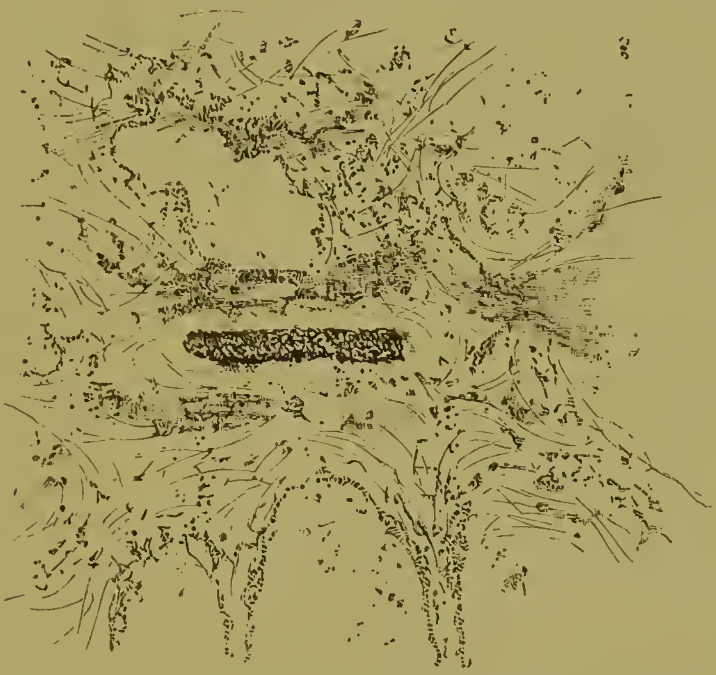
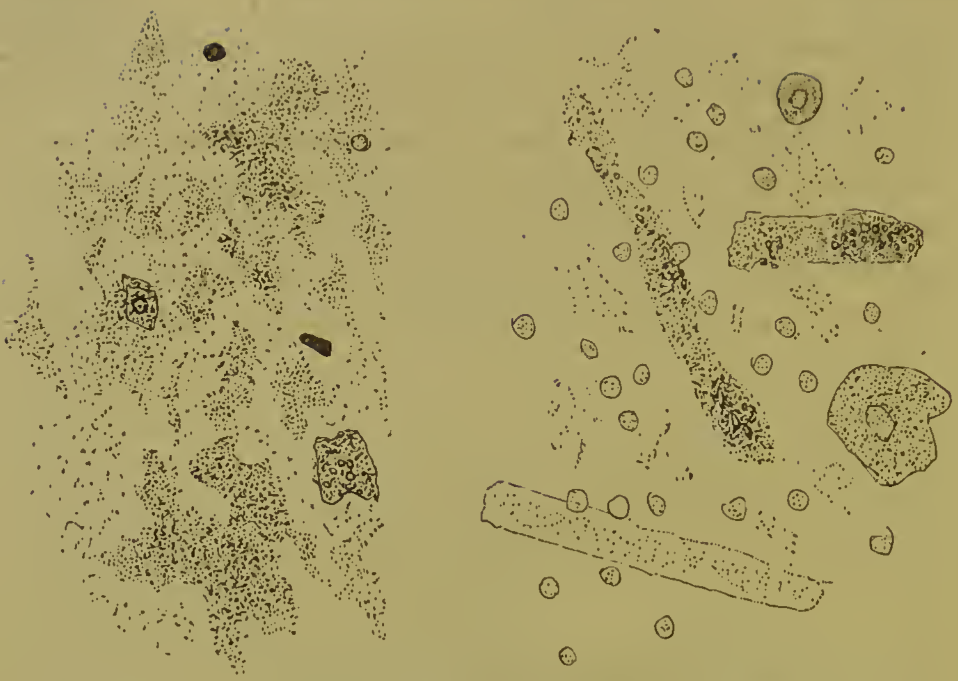
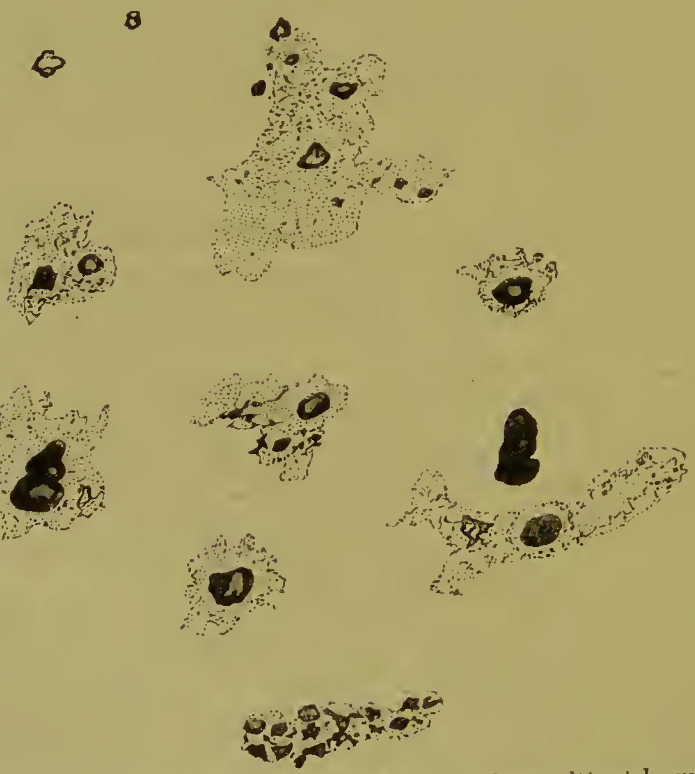
[1] Forrest and Finlayson, *Glasgow Med. Journ.*, 1879; Neale, *Lancet*, Nov. 1879, p. 725; M. Cazeneuve, *Lyon Med.* 1880, vol. xxxix. p. 89.



Nearly amorphous translucent web of fibrin imbedding sparkling specks and casts. From urine of a boy 5 years old during an attack of intermittent hæmaturia. (See p. 1216).



Urinary deposit in case of Edw. Harvey, April 1, 1878. Fine granular matter interspersed with bright yellow crystalloid masses, apparently blood-crystals. Two of these are represented black. Also granular casts and leucocytes. From drawing by the late E. H. Cowburn. See p. 1213.



Urinary deposit from John Dare, aged 34, with intermittent hæmaturia. Yellow translucent crystalloid masses, apparently imperfect blood-crystals, sprinkled through a faintly yellow finely granular web of irregular outline. No definite casts. × 900 D. (See p. 1208.)

characters, together with the spectroscopic evidence as to the urine, it is probable that they should be called oxyhæmoglobin, though the point is one upon which further observations are needed. Sir W. Gull[1] described them, in a case under his own care, as prismatic crystals of hæmatin.

Next to the presence of disintegrated blood prominence must be given to the absence, complete or nearly so, of corpuscles. Sometimes a few red corpuscles are to be seen, especially in the later stages of each attack, as if the modified hæmorrhage were succeeded or accompanied by traces of ordinary hæmorrhage; occasionally also a few leucocytes are associated with the other deposits; but such evidences of the escape of unaltered blood are trifling and probably secondary, and it frequently happens that not a single blood-corpuscle can be seen at any period in the course of the paroxysm. As an exception to these statements I may refer to the case of King (p. 1225), in which the disintegrated discharge occurred at one time and at another one wholly corpuscular, and I might refer to other cases in which considerable ordinary hæmorrhage has occurred together with or after the peculiar flux.

Mixed with the brown powdery sediment which has been described, and often chiefly composed of it, are casts of the renal tubes, usually somewhat narrow, as if the pulverulent material of which they are made had been moulded, together probably with some recognisable fibrine, in the normal channels. Besides such casts, hyaline and epithelial kinds may often be seen in considerable variety, should the special attack be succeeded, as often happens, by a transient condition of renal inflammation. In such cases renal epithelium is often found stained of a deep brown colour. Oxalate of lime and crystals of uric acid are found, the former frequently, the latter occasionally. Amorphous lithates are generally present, and that abundantly, in succession to the hæmorrhagic products as the attack is subsiding. Lithates may also present themselves as substitutes for these products in the imperfect or abortive attacks which are apt to occur on the decline of the disorder.

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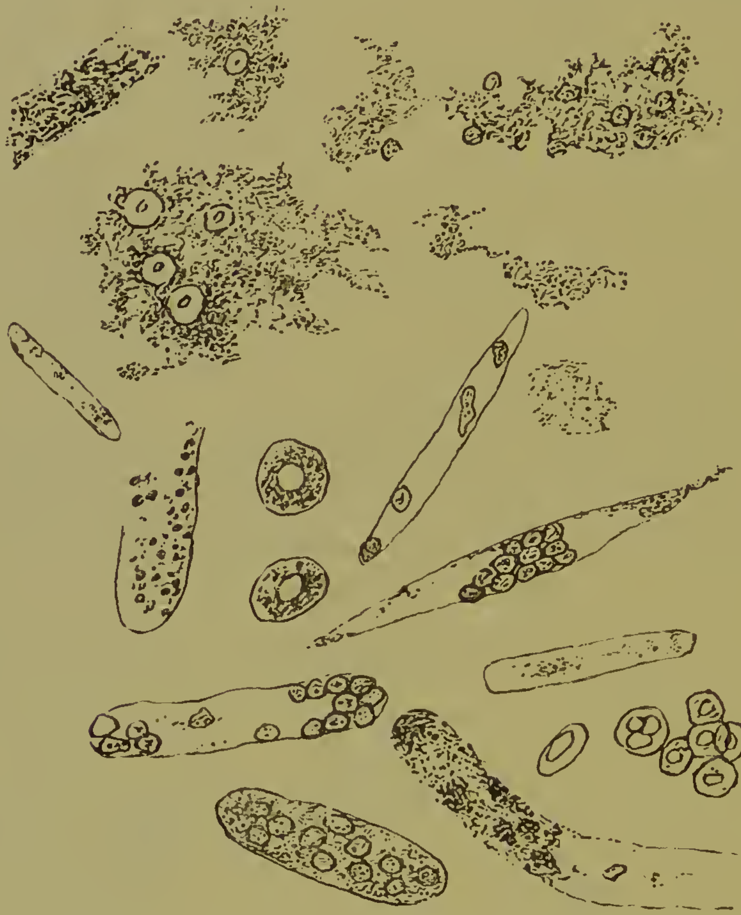
[1] A case of intermittent hæmatinuria. *Guy's Hospital Reports* for 1866, p. 381.

Variations in the normal constituents of the urine.

Attention has been directed rather to the abnormal than the normal constituents of the urine since the alterations are chiefly by way of addition. Under the paroxysm the diurnal quantity appears to be usually increased, as also is the specific gravity. In Dr. Druitt's



Urinary deposit in case of Cath. Evans from June 8 to 27. Amorphous brown granular matter held together by a faint translucent web. Many renal cells tinted of intense brown colour. Casts containing brown granular matter and epithelium. One was filled with translucent specks of yellow blood-pigment. Uric acid crystals were seen, but are not represented; neither are a few blood-corpuscles, which were found in the later examinations only. Generally magnified 260 D. Two cells of renal epithelium and the cast to their left are magnified 500 D. See page 1195.

case, in which the paroxysms were quotidian, the quantity ranged during 7 days from 40½ to 67 ounces; the sp. gr. from 1,007 to 1,028, generally higher when the sanguineous discharge was present than when it was not. My patient Parker (page 1217) passed on the day of a severe fit 1,525 C.C., which was his maximum as compared with other days, though not a marked increase. The specific gravity was taken for every urination during a week for which the urine was sometimes bloody and sometimes not. The average sp. gr. for 16 observations on which the urine was bloody was 1,015; for 22 observations on which it was clear it was 1,011. In a case I published in the 'Medico-Chirurgical Transactions' the specific gravity of the bloody urine was 1,025; the next urination, which was natural, had a specific gravity of 1,009. With regard to the urea during the paroxysm observations conflict. In Dr. Harley's cases[1] it was in increased proportion in the bloody urine, in one 3·6 per cent., in another 2·5 per cent.; the urine in the latter instance presenting before and after the attack the percentages of 1·7 and 1·8 only. In my case,[2] published in the same volume, the percentage of urea during two paroxysms was found to be 2·35 and 4·25 respectively, while in an interval it was 1·6 per cent. Later observations have given different results. In Dr. Druitt's case the urea during the paroxysms for three consecutive days ranged from 1·00 to 1·10 per cent., while two specimens of clear urine passed after the fit gave percentages of 1·62 and 2·26. The uric acid in Dr. Druitt's case was somewhat diminished during the paroxysm, increased on its subsidence. It is a matter of common observation that lithates are often superabundant after the blood has ceased to appear. Observations are wanting as to the mineral salts. In my case the chloride of sodium, both during the paroxysm and afterwards, was somewhat low; ·45 per cent. in the bloody urine, ·5 per cent. in the clear.

Some details may be referred to in the case of

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[1] *Med.-Chir. Trans.* for 1865, p. 161.

[2] *Ibid.*, p. 175.

Collingbourne (page 1203), which show that the variations of quantity, specific gravity, and urea as between the fit and the interval were not constant; the phosphoric acid was generally increased in the 24 hours which included the fit, the chlorine somewhat diminished, though during the hæmorrhage this constituent displayed a larger percentage than immediately after it. The indigo or similar pigment was seen in several of the appended cases to be much increased both during the hæmorrhage and in its absence.

Blood and serum.

The blood and serum have been examined under attacks of this disease with results which, though as yet scanty, are enough to show that products of corpuscular dissolution are present in the general circulation. Red blood-corpuscles withdrawn from a frigid great toe at the outset of a paroxysm have been described by Professor Murri[1] as distorted or deformed, while the surrounding serum displayed granular material. Further, blister fluid produced during an attack has been found to give evidence of hæmoglobin.[2] Besides these significant observations the ordinary blood conditions of anæmia have been found to be present in this disease.

Morbid anatomy.

With regard to the morbid anatomy of this disorder a case which was concluded by a post-mortem examination is related in an earlier part of this work (p. 311), in which the symptoms of it were somewhat equivocally associated with those of acute nephritis. Beyond that my own experience is limited to four instances, two of which I will proceed to relate, while two others, and those the more important, are placed at the end of the chapter. That first related displays the condition of the organs very shortly after the occurrence of the characteristic discharge, though my information does not allow me to state the exact time of death with regard to this symptom. The patient had long been the subject of elephantiasis, and died under the care of the late Dr. Tilbury Fox, who gave me the organs and the history.

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[1] Professor Murri, *Emoglobinuria da Freddo.* Bologna, 1880.

[2] Fleischer, *Berl. Klin. Wochenschrift,* 1881, No. 47. Hayem; case by Mesnet, *Archives Générales de Médecine,* May, 1881, p. 513.

Case of hæmeglobinuria associated with elephantiasia. State of organs shortly after attack.

'For the last ten years,' says Dr. Tilbury Fox, 'the patient has had what he calls shivering fits. At first he used to have them once every two or three months, but latterly as often as once a week. These fits began by shivering, which lasted two or three hours, and they were followed by a feeling of heat and a hot dry skin. He has also noticed that these phenomena were invariably succeeded by a corresponding enlargement of the leg and foot, attended with sharp pain in the leg, up to but not beyond the knee. The discharge, which is generally pretty profuse from the leg, and is of a serous character, has always been increased in amount in connection with these shivering fits. Recently he has noticed some additional occurrences in connection with the shivering fits. He has had headache after them, and has felt drowsy and sleepy before the attack, and during the fit he has been very thirsty, and his breathing has been very quick and difficult. His skin also has turned blue, and sometimes nearly black. This latter state of things he has noticed at times during the last two years, and the attack has passed off, leaving the patient very hot, and with a flushed, dry skin. The urine when in hospital was noticed for a few hours to be smoky, and it contained a large amount of hæmatin, but no actual blood-cells, save perhaps the remnants of a few.'

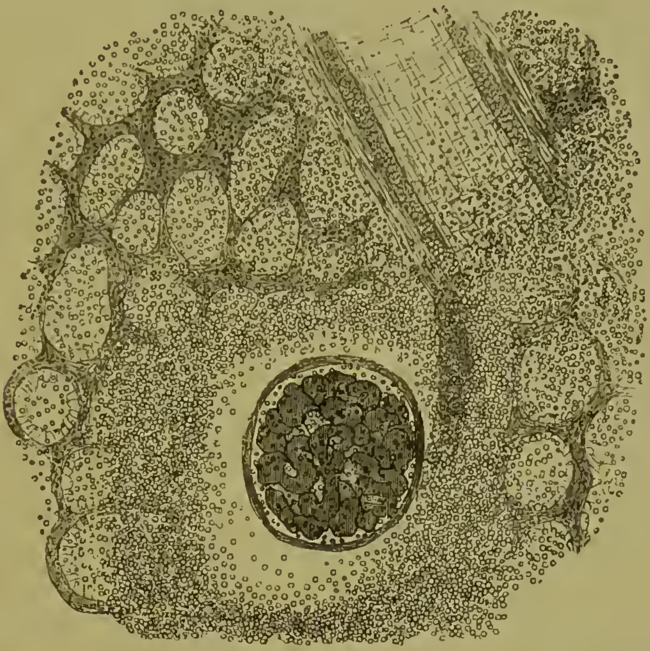
The kidneys together weighed seventeen ounces. They were smooth externally. The portion I received was highly injected, with evident cortical swelling. Under the microscope the most remarkable appearances were those of the blood-vessels. In scattered districts these were injected to the highest degree—crammed with blood-corpuscles, of which, within the smaller vessels, the outlines were everywhere distinctly visible. Scattered families or groups of vessels were thus affected, while the intervening spaces were free from injection, and nearly natural in every respect. The capillaries, and especially those in the cones, were the most strikingly affected, though the same condition was frequently observable within the malpighian vessels. In several instances the smaller and even the larger arteries were similarly packed with blood, and once or twice appearances of the same sort were noticed in considerable veins. Where the urinary tubes could be accurately distinguished from the blood-vessels, as always in the cortex, and generally in the cones, the blood was always confined to its proper channels. The condition, in a word, was intense, partial injection, mainly capillary and arterial. Beyond this there was some excess of epithelium, though not such as to block the tubes; and there were signs of hypernucleation of the interstitial tissue.

Case showing state of organs 25 days after paroxysm.

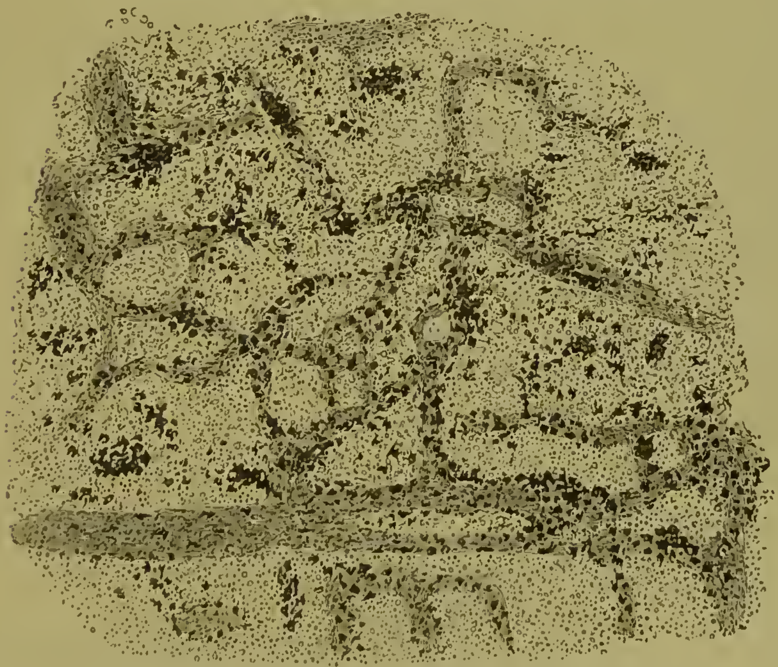
I may now refer to a case subsequently given in detail (Collingbourne, p. 1202) which presents the state of the organs twenty-five days after a paroxysm. The particulars may be condensed into the statement that there was intense injection, particularly about the junction of the cones and cortex, and several evidences of extravasation, the most marked of which was an interstitial mass of blood, of irregular shape, three or four times the diameter of a malpighian body. The extravasations appeared to be chiefly of arterial origin, and to consist mainly of corpuscles, but in part of granular matter, apparently the result of their disintegration. I shall place next an instance also related in full later on (Cath. Evans, p. 1198), in which death occurred two months after the cessation of a severe and long-continued hæmorrhage of the kind in question, which was sequent upon malarial fever. Extravasations were found in many parts, whether connected with intermittent hæmaturia, or directly with malaria; there were corpuscular extravasations in the liver and a preposterous quantity of blood-pigment in the spleen as shown in woodcut, p. 1179. The kidneys were marked by intense injection, and contained minute extravasations in connection both with the cones and cortices, the most striking of which surrounded a malpighian body, as represented in woodcut, p. 1179. The extravasations appeared to be wholly corpuscular, both of red and white. There were evidences of tubal and interstitial nephritis, and the tubes contained granules of blood-pigment. Together with these facts I must revert to the remarkable case of congestive nephritis related in an earlier part of this work (p. 311), which presumably took its origin in the intermittent condition, though the clinical evidence was not complete on this point. The kidneys were not only in-

Another showing their condition 2 months after paroxysm.

tensely congested, but both had burst their capsules, with much superficial extravasation, an exceptional result of



Hæmorrhage around a malpighian body and about the adjacent structures in case of Evans. See p. 1198.



Granules of pigment in spleen in case in which hæmoglobinuria was associated with malarial fever. C. Evans, p. 1198.

renal disease which cannot but point to a connection between that case and those more recently adduced. In this case, in addition to the tubal and interstitial results of acute nephritis, many of the tubes were lined, with black, granular matter, evidently blood, for the most part, though not entirely deprived of its corpuscular shape.

Another showing their state after subsidence of disease.

The following narrative gives testimony as to the state of the organs after the apparent subsidence of the disease. As in the previous case the nature of the disorder was not demonstrated by urinary examination though placed beyond doubt by the history.

In March 1869, William Lynes, an excavator, 45 years of age, was sent to me at St. George's by Dr. Forshall of Highgate as the subject of Intermittent Hæmaturia. He had had a severe attack of tertian ague at the age of 26, while employed in draining Whittlesea Mere, but recovered and remained apparently well, until 9 years later, one frosty morning, he had a return of 'the shakes,' passed black urine, and then sweated profusely. Every winter since he had several such attacks and with increasing severity. These were very characteristic; the water with a black sediment like coffee-grounds, the upper stratum resembling bright port wine. The urine resumed its natural characters usually in about 12 hours. The seizures, of which the shivering and sweating were strongly declared, came on only from cold, not periodically. Before the attack of ague the patient had had a chancre, and on more than one occasion afterwards had ulceration of the throat. He frequently suffered from epistaxis. While in the hospital he remained free from the disorder, notwithstanding that he was sent out on several exceptionally cold days. The urine was free from albumen and natural in all respects. After his dismissal he was kept under observation for a considerable time, but had no return of the complaint. He had been persistently treated with quinine. In June, 1873, I heard from Dr. Forshall that he had died, and received at the same time the larger viscera, which had been recently removed from the body. These were minutely examined, with results which may be briefly stated. The heart was covered with old pericardial adhesions, the left ventricle was much hypertrophied, the valves healthy excepting that there was a little general atheroma. One lung (which only was sent to me) was compressed to sinking evidently by pleural fluid. In other respects it was healthy. The kidneys had thickened and adherent capsules, they were contracted but not extremely, they had finely granular surfaces and a few cysts in their cortices, which portions of the organ were somewhat shrunken. The liver was in a condition of early cirrhosis. It was not much reduced in bulk or roughened on surface, but the capsule was thickened, and on section the portal fibrous tissue was increased while the glandular structure was somewhat globulated. The epithelium was fatty but not excessively. The spleen was firm in texture and somewhat increased in bulk, it could not be accurately weighed, but measured 5 inches long and 1½ inch in thickness. The capsule was thickened and the internal fibrous tissue obviously increased.

Beyond these evidences of ordinary fibrotic change, slight save in the kidneys, no morbid changes were discerned, though sought for somewhat carefully and with the microscope. The man had evidently died of granular degeneration of the kidneys, with attendant cardiac and pleural disorder. There was nothing to give other than negative evidence with regard to the morbid anatomy of the disease from which he had once suffered.

Other *post-mortem* evidence.

Since these cases have occurred several other post-mortem examinations have been recorded, but none which throw any further light upon the disease. We owe two to Professor Murri of Bologna, one upon a patient also syphilitic, who died apparently of tuberculosis seven months after his last attack of hæmoglobinuria. There was general miliary tuberculosis. The kidneys were of unequal size; the left natural to the naked eye excepting a few tubercles, the right hyperæmic and with an increased cortex. Upon microscopic examination besides the tubercles which were present in both, it was found that the interstitial tissue was increased, the epithelium in some parts of the cortex swollen and detached, and collections of yellow and black pigment seen in the cortical tubes.

Inferences from preceding cases.

Taking these cases together with the perfectly natural action of the kidney often observed during life in the intervals of the attacks, we may conclude that no permanent or structural change either of the kidney or of any other organ is necessarily involved in the disorder.

But at the same time interest must necessarily attach to the extravasations which were found in three cases, if the third, in which the capsules were thus ruptured, may—of which there seems to be little doubt—be reckoned as of the same nature, and to the remarkable and intense injection which was uniformly observed when the hæmaturia was of recent date. We thus may regard intense renal hyperæmia frequently accompanied with extravasation as the immediate result of the attack, while tubal catarrh, interstitial overgrowth, and chronic fibrosis are to be traced as sometimes consequent upon it, due probably to the repeated congestion which the disease involves. The renal changes, essentially consisting of hyperæmia which is usually transient, are consistent with the belief that the disorder is primarily of the blood, the kidneys affected only as the channels of elimination.

General view of phenomena.

With the facts now before us we may take a general view of the phenomena of the disease. They have been differently interpreted. Dr. George Harley[1] was led by the jaundiced appearance to infer that the attacks were in some way connected with disturbance of the hepatic function. I ventured at the same time[2] to attribute the symptoms to a disintegration of blood-corpuscles within their proper vessels, and the subsequent discharge of the débris by the kidneys rather than to any hepatic or primarily renal change. The view which thus presented itself nearly twenty years ago has now found general acceptance. Sir W. Gull[3] held, that whatever the primary change might be, there was at least good evidence that the kidneys were affected, and adduced in instance of the renal source of the disorder the case of a lady who passed the urine characteristic of it in consequence of having received an injury to the loins.[4] Dr. Greenhow, the next commentator, used the term dyscrasia in connection with the disorder, and while admitting the evidences of renal congestion during the attack which are sufficiently obvious, accepted the view which placed the essential change in the blood.

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[1] *Med.-Chir. Trans.*, 1865, p. 170.

[2] *Ibid.*, 1865, p. 183.

[3] *Guy's Hospital Reports*, 1866, p. 390.

[4] *Clin. Soc. Trans.*, 1868, p. 52.

Dr. Stephen Mackenzie,[1] to whom we are indebted for an able and comprehensive paper on the disease, though formerly he thought that the corpuscular destruction occurred in the kidney, has found himself unable to resist the accumulated evidence that it takes place in the general circulation. And that it is here would seem now beyond doubt, since the products of corpuscular dissolution, hæmoglobin, and, according to Murri, granular matter, have been found in the serum or liquor sanguinis. In what system of vessels the destruction takes place may be less certain than the fact of its occurrence, but it has been supposed with probability to come to pass in the parts of the body, chiefly the extremities, the blueness and coldness of which mark the outset of the attack. In these regions of local cyanosis, from which Professor Murri infers that the arterial blood is shut by a spasmodic vascular action, he supposes that the corpuscles are broken down by the combined action of cold and carbonic acid, to be eventually eliminated by the kidneys.

It has been often observed, as in Sir W. Jenner's patient (p. 1208), that a feeling of general illness precedes any urinary change, any lumbar pain or renal symptoms. The rigor probably marks the time of contamination. A rigor, says John Hunter, is commonly the first symptom of a constitutional affection. And whether the poison be febrile or septic, the truth expressed is one of daily experience. The change in the urine is subsequent and probably due to an escape by the kidneys of the morbid product. Dissolved or broken-up corpuscles cast loose into the circulation may easily account for the tinting of the skin as if by hæmatine; and also for the articular effusions, presumptively of blood or blood substance, which were observed in the cases of Evans and Baker, as if the blood waste had sought other exits beside the renal. That the kidneys become congested, sometimes intensely so, under the process, is evinced by the lumbar pain, the retraction of the testicles, and the other passing signs of irritation which they manifest; there is even the suggestion of the case, to which I need not again recur, that they may become congested to bursting or fatally inflamed under the disturbance. But it is clear that whatever happens to the kidneys is consequent upon the disorder, not antecedent to it. The natural action of these organs in the intervals, and the post-mortem evidence which we have, are sufficient to show that their change of function is due to passing circumstances, not to permanent change.

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[1] *Lancet*, 1884, vol. i. pp. 156, 198, 213.

Hæmoglobinuria of other kinds.

Apart from hæmoglobinuria as an intermittent or paroxysmal disorder, a similar condition of urine is known to occur as the consequence of many states of blood, some produced by disease, others by matters artificially introduced. It has long been known that the inhalation of arseniuretted hydrogen produced a condition of urine in which blood was apparently dissolved, and the same result has been extended to other toxic agents, among which may be mentioned naphtha, benzol, hydrochloric acid, and chlorate of potash. With regard to the latter, Dr. Dreschfield and Mr. Stocks have recorded the case of a woman who, after taking in the course of twenty-four hours an ounce and a half of chlorate of potash, passed hæmoglobin in the urine, by vomiting, from the rectum, and from the vagina. The convoluted and straight tubes of the kidneys were filled partly with granules, and partly with blood-corpuscles, in which the colouring matter appeared to be precipitated. The malpighian bodies were natural. Blood-corpuscles are known to be soluble in water, and it has been stated that the injection of water into the veins of animals, as well as of glycerine and water into the cellular tissue, have been followed by the exit of dissolved blood with the urine, and the same result has been noted in dogs who have been subjected to a starvation diet of sugar and water. The same condition has been found in the human subject in connection with certain septicæmic and fibrile conditions, among which is typhus; and it is said also to have been found with scurvy and purpura, though I may say that in my own not very large experience of the latter disorders I have noticed the blood discharged with the urine to retain the corpuscular form.[1] Thus it appears that blood-corpuscles may be dissolved within the body by many agents and in many circumstances, and the product make its way out by the kidneys; but these conditions of hæmoglobinuria, in which the solution is ostensibly and primarily due to some toxic agent in the blood, or change in its composition, present only a partial analogy with the obscure and recurrent disorder under consideration.

Analogy with Reynaud's disease.

A closer analogue to this is occasionally presented in cases of the symmetrical gangrene, or localised asphyxia of Reynaud. This condition may concur with the state of urine which has been under discussion: and, indeed, the disorder of Reynaud appears to be so closely connected with intermittent hæmaturia that no distinct line of demarcation can be drawn between the two. (See case of Collingbourne.) The essentials of Reynaud's disease are the arrest of circulation, with coldness, blueness, and often subsequent gangrene, in certain parts often prominent, such as fingers or toes, and often disposed with bilateral symmetry. In certain instances and in certain phases of this disease hæmaturia has occurred and recurred, much after the manner of the intermittent hæmorrhage under discussion, either with the escape of corpuscles or as hæmoglobinuria. A boy, whose case is related by Dr. Wilks,[2] had after protracted suppuration, the result of an injury, gangrene of the fingers, such as is described by Reynaud, attended with the discharge of hæmoglobin and casts with urine, with only the occasional presence of corpuscles. Dr. Southey gives the case of a lad who had gangrene, first of the right index and then of other fingers, while purple patches, which threatened to lead to the same condition, appeared on one ear and the nose. The parts about to become gangrenous first became red, swollen, throbbing, and hot like chilblains. The skin generally was peculiarly sensitive to cold impressions, becoming on exposure remarkably mottled, while parts that were covered were apt to become hot and red, and throbbed and burned, so that he could no longer bear anything upon them. The mottlings referred to developed into patches of urticaria, which presented themselves widely over the face, trunk, and limbs. The urine became bloody under superficial cold; then, after exposure and being washed, it would be bloody; a few hours later not so. Blood-corpuscles were found, but no casts; the urine was often albuminous out of proportion to the blood. No hæmorrhages occurred, except with the urine; there was no dropsy. In this case, though the hæmaturia might be termed intermittent or paroxysmal, there was no evidence of the corpuscular destruction which belongs in what is termed hæmoglobinuria.

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[1] M. Cazeneuve, *Lyon Méd.*, 1880, p. 88. M. Mesnet, *Archives Générales de Médecine*, vol. i. 1881, p. 513. Dr. Dreschfield and Mr. Stocks, *Trans. of International Med. Congress*, vol. i. p. 398. Dr. Saundby, *Birmingham Med. Review*. March 1882, p. 97.

[2] *Med. Times and Gazette*, 1879, vol. ii. p. 207.

A case recorded by Dr. Barlow is more to this point. The subject was a girl five years of age who had, especially in cold weather, repeated attacks of coldness, blueness, and pain in one or both feet, or one hand, which lasted several hours, but did not proceed to gangrene. Some of these attacks, but not all, were attended with the passing of urine, usually once only, which had all the hæmoglobinuric character. It was very dark; contained no corpuscles, but much brown granular matter; gave a blue reaction with guaiacum, an albuminous clot of a tenth, and a deposit of oxalate of lime. Occasionally under the attacks the urine became lithatic, but not bloody. The coldness in the limbs was often preceded by abdominal pain. Dr. Barlow points out—what indeed is sufficiently striking—the resemblance between this combination of symptoms and that described as intermittent or paroxysmal hæmoglobinuria. The condition of urine may be the same in both, even to the lithiasis which appears to replace the peculiar hæmorrhage. The attacks occur usually with the same irregularity and from similar causes; in both abdominal pain, yawning, and vomiting may mark the beginning of the attack, and in both urticaria may present itself. The difference may declare itself by little else than the more narrow limitation, and the greater intensity, of the superficial arrest of circulation in the one case than in the other. Indeed, the two conditions seem so to approach each other and mingle as to make it impossible to make a distinct demarcation between them.

Rationale of intermittent hæmoglobinuria.

With the facts which have been passed in detail it will now be possible to present in brief retrospect a rational view of the intermittent condition of hæmoglobinuria. It occurs independently of organic disease, though the kidney is concerned usually temporarily in the attacks, but depends on a destruction of blood within its proper vessels from causes which have to be considered. The association of the disorder with malarial fever and its sequence, without the intervention of fever upon malarial exposure, is such as to lead to the inference that at least in many cases it is but ague misdirected. With ague of the common sort we may presume that the rigor indicates the presence of a poison in the blood, which is presently eliminated by sweating and the discharge of lithates with the urine. With the hæmaturic attack the disorder points renally. The heat of skin is not indeed always absent, but is usually little marked, to be replaced, as we may fairly infer, by a corresponding condition of kidney, with relief by renal instead of cutaneous evacuation. The frequent mixture of lithates with hæmaturic discharge, and their substitution for or succession upon it, bears out the analogy.

The increase of urea, which is so marked under the ordinary ague fit, is not equally so with that of hæmoglobinuria: probably the materials which should form the urea are expended as hæmorrhage. Under paroxysms of ague the urine has often been found to be albuminous, and sometimes bloody: the hæmaturia of an ague fit may be attended with corpuscular disintegration, and the one disease may pass into the other (as in the instance of Catherine Evans, page 1193), so that the two conditions present themselves but as phases of the same disease.

This is seen with the malignant malarial disorder described as bilious or hæmaturic fever, in which it is said that the urine presents the hæmoglobinuric characters.[1] The renal congestion of the ague fit is indeed a prominent fact in its pathology, and is probably the means by which granulation of the kidney is brought about, as has been insisted upon in an earlier section of this work, by intermittent fever. And not only are the two disorders associated by the renal congestion common to both, but it would seem, from the anæmiating results of common intermittents as well as from the diffusion of pigmentary products under their influence, and the occasional yellow tinting of the skin, that with them as with hæmoglobinuria there is extensive destruction of blood in its own vessels. Another point of resemblance is to be found in the enlargement of the spleen common with ordinary ague and occasionally found in the hæmorrhagic disorder. The heaps of blood-pigment found in the spleen of Catherine Evans (see woodcut, page 1179), are quite such as might have belonged to malarial disease, with which, indeed, this case was associated, insomuch that it might have been termed, with equal truth, hæmoglobinuria or malarial fever.

But the association with malaria, though possibly more frequent than our records show, does not comprise the whole history of the condition. Cases present themselves in which no malarial influence can be ascertained or suspected. I have adverted to the occurrence of hæmoglobinuria with the local asphyxia of Reynaud. We do not know enough of this condition to assert that it is regularly, or often, of malarial antecedents, but Reynaud has given a case on the authority of Dr. Landry in which this sequence held; and it must be noted in connection with this occurrence that gangrene has frequently been observed in connection with, and apparently as a result of, malarial fevers.[1]

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[1] Corre, *Arch. de Méd.*, Nov. 1881. *Gazette Hebdomadaire*, April 1881, p. 249.

Whatever be the remote cause of the condition, it appears that the immediate precursor of the discharge is contraction of the superficial arteries, whether in connection with ague, with the local asphyxia of Reynaud, or, possibly, independently of both, as belonging to an isolated and unexplained form of hæmoglobinuria. We may accept provisionally the view of Professor Murri, that the corpuscular destruction takes place in the superficial vessels in which the stagnation has occurred, and that arterial spasm, whatever be its cause, is the essential factor in the disease.

These conclusions are not contradicted by the exceptional appearance of the disorder after violence, exercise, and alcoholic excess; the disease has not been thus created; the attacks have been brought on in a person who has previously acquired the liability.

Treatment.

As to treatment: tenacious as the disorder proves itself in many cases, there are others which show that, independently of medicine, it has a tendency to recovery. No patient is as yet known to have died directly of the disease, though many have died with it; some have been apparently cured, and others have outlived it. The measures which are indicated are of two kinds: quinine as possibly curative of the disorder; uniform warmth as preventive of the attacks.

The most remarkable point in the therapeutics of the complaint is the effect of temperature. Patients when attacked instinctively seek warmth; go to bed if they can, cover themselves with clothes, and await the relief which the warmth brings. In most instances cold is the only exciting cause of the attacks; in constant warmth they are totally absent. Even where, as in the case of Dr. Druitt, the disorder in a temperate climate has displayed a periodic or diurnal tendency, its habit in that respect has been completely broken by a tropical temperature. Dr. Druitt had but one attack of his disorder, and that brought on by a definite chill, during his winter in Madras. Possibly some such tropical, or a subtropical, resort, with quinine if indicated, and especial care to avoid malaria, would be more often desirable than attainable in this disease. Where not attainable, much may be done with warm clothing and by the avoidance of exposure, together with a dietary including wine or some alcoholic drink, somewhat oftener than might otherwise be needed. Such measures may keep off the attacks; and with a disorder often of limited duration, this may be equivalent to curing the disease. Dr. Barlow[1] found that a patient of his who from childhood had been washed in very hot water, became less susceptible to the disorder when cold water had been gradually substituted for hot: the suggestion presented must be put to the test of further experience.

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[1] Hertz, Malarial Diseases, *Ziemssen's Cyclopædia*, vol. ii. p. 613.

As to pharmaceutical measures, quinine takes the first place. Obviously suggested by the aguish similitude and the occasional aguish antecedents of the disease, the remedy is no novelty in this relation. It was, as already stated, employed by Prout. Though its specific action appears to be less marked than with the common forms of ague, the facts which have been accumulated do not allow us to doubt that something of the same effect must be attributed to it. Dr. Druitt, who spoke from an experience which probably no other member of the profession can adduce, says, 'of medicines deserving the name there was but one, and that was quinine in full doses.' He found that the attacks were kept off by large doses of the drug, but that its beneficial effect diminished with repetition, until at last, though it still continued to be generally beneficial to health, it lost its control over the hæmorrhage. And many other cases testify at least to the suspension of the disorder under quinine, while with some it has totally ceased under its influence.

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[1] *Clin. Trans.*, vol. xvi. p. 188.

My own experience amounts to this: I have treated seven patients with quinine alone; four with quinine and iron; one with quinine and iodide of potassium; one with iodide of potassium alone; one with iron alone; and several without medicine. The results are detailed in the appended cases. Of those who took quinine alone, five were obviously benefited, two of whom were apparently cured. In one the remedy was discontinued on the occurrence of measles; in another no definite result was obtained. Two considerations make it difficult to estimate the effects of any remedy in this disorder: one is the capricious manner in which it will sometimes come to an end; the other is its tendency to recur after a long interval when thought to be cured. The cases most amenable are those in which the aguish antecedents are most distinct. The man whose case I brought before the Medico-Chirurgical Society in the year 1865, who had had ague fourteen years before his attack, and was attacked in an aguish district, having all but died under the combined effects of mercury and pneumonia, lost his symptoms under quinine and iron, left the hospital apparently well, and when by chance I saw him four years later (1869), had had no return.

The man whose case is related at p. 1220, who had had a malarial affection three years before the hæmaturia, lost the latter under quinine and iron, and three years later was still free. In five cases the attacks ceased to occur under full doses of quinine conjoined, in two of them, with iron, though the evidence of recovery is inconclusive. In one of these (that of Cath. Evans, p. 1193), the hæmaturic symptoms entirely ceased, and remained absent until her death, which was due to another cause. The remaining four patients—Madden, Hercock, Taylor, and Jones—left the hospital apparently well, though it was not known how long they remained so. Two cases, treated with quinine alone, left the hospital apparently well, but had recurrences afterwards (R. Baker and Stone). The quinine to be effective, whether permanently or temporarily, needed to be given in full doses, generally about twenty grains a day. One of these, a child nine years of age, had recurrences under six grains a day, none under nine grains.

Other drugs may be more briefly dismissed. Arsenic has been used, and may be useful as an antiperiodic, should quinine fail or be inadmissible. Antisyphilitic measures have been resorted to, though we have no reason to suppose that syphilis is often, or especially, associated with the disease. Yet it may co-exist, and in two of my cases iodide of potassium was given with apparent advantage. Professor Murri has attributed benefit to mercury in similar circumstances. Apart from syphilis, mercury proved so obviously injurious in a case I have already adverted to, that I have refrained from employing it. The yellowness of the skin has occasionally directed the efforts of the practitioner to the liver, and suggested mercurials, nitro-muriatic acid, and other reputed remedies for jaundice. But bile is not wanting in the motions; and if the colour of skin is by blood and not by bile, such drugs at best are useless. The action of this metal in reducing the number of blood-corpuscles and causing anæmia would seem to render it better suited to increase than to diminish the effects of the disorder.

Of direct means of stopping the hæmorrhage there are none except it be warmth. Iron is an obvious requirement to mitigate the results of the hæmorrhage, and may be given in an astringent form.

The following cases may serve to fill up some of the deficiencies in the preceding account. For the opportunity of observing one of them I am indebted to Sir W. Jenner. Another is quoted from the narrative of the sufferer. For the others the responsibility must fall upon myself. The comparative infrequency of the disease must excuse the length at which I have recorded my experience.

On June 7, 1877, I was asked by Mr. Fuller to see a young woman who was passing large quantities of blood with the urine.

Malarial fever associated with typhoid. Disintegrated blood discharge with urine. Purpura: local swellings: nephritis and dropsy. Death from perforation of bowel.

She was thirty-two years of age, a lady's maid. Her health had always been good, excepting that she had been liable to attacks of vomiting, so-called bilious attacks, until this illness, which dated from a certain day towards the close of the preceding April, on which while voyaging homewards in a yacht, after a prolonged tour in the Mediterranean, she went ashore at Port Mahon in Minorca, and walked for several miles inland. She came home much fatigued; for the two or three subsequent days had a general feeling of illness, with aching in the bones, and for the rest of the way home frequent sickness, feverishness, with incomplete and irregular shivering. On reaching London she was placed under the care of Mr. Fuller, who saw her on May 5, and recognised her condition as one of malarial fever. Her morning temperature was from 99·5° to 100°; this was daily succeeded by creepings, chilliness, imperfect rigors, and a temperature which by the afternoon had reached 103·5° or 104°, this falling during the night with profuse sweating. The liver was enlarged to the touch, the skin yellowish, the alvine discharges seldom and pale, the urine free from albumen, but tinged apparently with bile. Under purgatives, followed by quinine, she had so far recovered by May 24 that it was arranged that she should leave her room as convalescent on the morrow. But before doing so she was present at the unpacking of some boxes of apparel in her charge which had been recently landed. The clothes were found to be wet through with sea-water, to their detriment and hers; for whether from the agitating nature of the scene, or the handling of the wet garments, she relapsed into a condition resembling but in one respect that from which she had emerged. Together with a return of the intermittent febrile symptoms, she had great pain in the loins, without at first any change in the urine, which was pale and natural; but on the 29th this secretion became nearly black as if with blood. With succeeding days the discolouration of the urine rather increased than diminished, and further symptoms displayed themselves, a condition like that of rheumatism which involved the joints of the left upper extremity, certain lumps or localised œdemata which will be more particularly described, and spots of purpura.

On June 7 I first saw her. Up to this date, as well as for many later particulars, I am largely indebted to Mr. Fuller's observation. She had an aspect of much febrile prostration; her face was bloated, and the right eyelids intensely œdematous, so as to close them as if there were some cause of swelling limited to that eye; but there was no stye, nor any ecchymosis or redness; as much of the conjunctiva as could be exposed was natural. On the left temple was a circumscribed œdematous lump, like a bruise, except that it was not discoloured; there was no general œdema of the face, nor any of the legs or elsewhere, but the right shoulder, elbow, and wrist were red and painful, as if from rheumatism. No fluid could be detected in the synovial cavities, and it was thought that the joint symptoms were on the mend. The complexion was sallow, though not to be called yellow, giving a suggestion of blood-poisoning more nearly related to septic influence than to uræmia. There were a few spots of purpura now fading about both elbows. The liver could not be felt below the ribs, nor the spleen at all. There was no sign of pneumonia, nor was there any abnormal sound with the heart. The pulse was 140; the tongue coated and somewhat dry; the temperature now (7 p.m.) 102°.

Taking into consideration the repeated rigors, the discolouration of the skin, the rheumatoid symptoms, and the purpura, together with the defined swellings about the orbit and temple, presumably either hæmorrhagic or the results of venous clotting, it was clear that the conditions were not such as could ensue upon simple nephritis, but were to be ascribed to a state of blood which mere nephritis is insufficient to produce. It was necessary to regard the renal congestion, as evinced by the hæmaturia and lumbar pains, as but one of a series of common results. As to the common cause, pyæmia was negatived by the absence of any discoverable injury, by the freedom of the lungs from even the smallest signs of pneumonia, and by the absence of fluid from the affected joints, together with the decided mitigation in the symptoms affecting them. The history and the symptoms alike pointed to intermittent hæmaturia; which indication found verification as soon as the urine could be placed under the microscope.

This secretion was of the colour of porter, and did not differ at first sight from common bloody urine, but after standing it deposited a bulky sediment nearly the colour of the crust of port wine, leaving the superstratum clear, bright and tawny, with a tint between Vogel's 6 and 7 'red' and 'brownish red.' The deposit under the microscope consisted of a delicately granular or amorphous web, in which were included a large number of cells of renal epithelium, which were much swollen and coloured to a deep red-brown, as if stained with blood, but not a single blood-corpuscle could be discovered. Numbers of large casts were seen, some of which contained such epithelial cells as have been mentioned and other yellow indeterminate specks. Linear and dumb-bell bacteria were closely distributed everywhere, crystals of uric acid were large and numerous, but no oxalate of lime could be found. It is to be added that neither on this nor any subsequent examination could any blood-crystals or yellow specks be discovered, even with high powers. The urine was intensely acid, it gave with heat an albuminous clot of a third, which nitric acid did not perceptibly lessen.

Enquiring more particularly as to the relation of the fever to the hæmaturia, it was somewhat indefinite. The patient had shivered on the morning before the blood appeared, but the hæmorrhage went on steadily from day to day without any intermittent character. Early in the disorder the fever in its daily access and nightly remission had a distinctly quotidian type, but later, both before the urine became bloody and afterwards, imperfect rigors, creepings, and horripilations presented themselves without regularity.

Presuming upon the nature of the case even before the urine was examined, quinine was resumed; at first as the sulphate, at the rate of 5 grains, shortly increased to 7 grains, every four hours; this causing sickness, was changed to the hydrochlorate, and thus continued without inconvenience.

The patient immediately and greatly improved. Next day the urine was a shade paler and the albumen diminished to a fourth. There were still numerous casts but no blood-corpuscles, blood-crystals, or yellow particles. On the 9th a few blood-corpuscles were discovered, and now the epithelium, which hitherto had been deeply tinted, was paler. There was a heavy brown sediment, no longer amorphous, but consisting of casts and renal epithelium; the urine was, as it had always been, fairly plentiful.

An attack of diarrhœa on the 12th made it necessary to lessen the quinine. The left arm had now become œdematous, which condition, as I learned from Mr. Fuller, gradually extended to the whole surface of the body, while the right pleura and the peritoneum also gave signs of containing fluid. The heart at this time was turbulent, a murmur, whether anæmic or valvular, was widely distributed, and the pulse ranged from 140 to 160, and there was much dyspnœa, so that the patient could not rest but in a chair.

Under digitalis and iron these conditions gradually mended, while the urine slowly resumed its normal characters. This on the 27th was still tinted with blood, though more faintly, about Vogel's No. 5 or yellowish red. There was a large deposit which consisted of renal epithelium still coloured brown, granular casts, crystals of uric acid, and a quantity of pulverulent deposit which was closely intermixed with bacteria. Heat now gave a coagulum of $\frac{1}{8}$th, which nitric acid almost wholly dissolved. There was a copious precipitate with nitric acid in the cold, none with acetic acid. From this time the improvement both in general symptoms and in the state of the urine continued; by the middle of July all dropsy and most of the dyspnœa had gone, leaving weakness and want of appetite as the chief troubles. It was noticed that any attempts to give solid food were at first followed by a rise of temperature up to 103·5° or 104·0°; under the influences of time and nitro-muriatic acid this result ceased to ensue, and on July 25 she was remitted to St. George's Hospital, there, as it was hoped, to complete her convalescence.

It should have been mentioned that the menstrual discharge was due but did not occur about the time of the beginning of the renal hæmorrhage. The next period, while it was on the wane, was attended with the normal evacuation. I have not described the treatment in daily detail, but she suffered much from constipation, and was once much relieved by the removal by injection of a large collection of hardened fæces.

On admission her face had an earthy tint which gradually deepened so that a sort of sunburnt brown replaced the former pallor. There was no dropsy nor any more definite complaints than of weakness and want of appetite. A soft systolic murmur, apparently anæmic, was audible both to right and left of sternum at the base of the heart. The urine was of a dirty yellow colour, not obviously abnormal in appearance; it was albuminous to $\frac{1}{14}$th, and gave a slight brownish deposit which consisted of blood-corpuscles with a few granular casts and some squamous epithelium.

The abdomen was generally and indefinitely hard; neither the liver nor the spleen could be felt, though the position of the latter organ was somewhat tender.

In the hospital the urine became nearly natural, retaining only a trace of albumen; but the general condition did not improve. She remained feeble, wholly without appetite, and vomited at first infrequently, but after a time more often, even for several days together, after every attempt to take food. On August 18 she began to have diarrhœa, which continued in spite of all that could be done, was attended with occasional rigors and followed by rapidly increasing prostration, subsultus, and delirium. On the 25th she became unconscious and died.

Post-mortem examination.

The body was well nourished: it contained a good deal of yellow fat: the superficial veins were blood-stained: on the belly were a few ecchymoses. The immediate cause of the diarrhœa and death was perforation of the intestine and limited extrusion of its contents. In the lower part of the pelvis, behind the pubic arch, was an irregular cavity circumscribed by adhesions; this lay transversely across the pelvis, in contact with the upper and back part of the bladder. It would have held about a pint. At the time of examination it was nearly empty, though on pressure of the neighbouring bowel a little fæcal matter appeared in it. The surrounding intestines were matted together; a single coil crossed the cavity. Opening into this space were two ulcers, each about as large as a silver penny, though somewhat triangular in shape, which were separated from each other only by a narrow band of mucous membrane, and each of which made a free communication between the interior of the bowel and the space without. These were in the small intestine, though so much were the bowels matted together that it was not practicable to determine their exact situation. The portion of bowel where the perforations were was extensively patched with dark cicatricial tissue, such as might have resulted from typhoid ulceration, which origin also was with probability to be assigned to the perforations. The rectum which was in the immediate vicinity of the cavity was natural. The vagina, uterus, and ovaries also in close relation to the cavity were natural. The lungs were congested and œdematous, one minute cretaceous tubercle was found. The heart was of a normal size (ten ounces), it was of a light buff colour; the muscular fibres as seen with the microscope appeared to consist of closely packed small oil-globules, to the almost total exclusion of the striæ. A little soft atheroma was found on the aortic and mitral valves. The blood was generally fluid, though there were one or two small coagula in the right ventricle. The liver weighed 6 lbs. 2 ozs. It was smooth on the surface, except one or two small depressions, such as belong to early cirrhosis; in substance it was fatty to the most extreme degree; the section was like that of *foie gras*, of a very light yellow, uniform and greasy. The tissue floated in water. Detached cells of epithelium, as seen with the microscope, were swollen with large oil-globules, while in section the structure displayed little else than these bodies in uniform arrangement to the exclusion of the normal hepatic structure. Many of the portal canals displayed the results of extravasation, though not to such an extent as was apparent with the spleen and kidney. The tissue around the blood-vessels was at many points stuffed with extruded leucocytes in dense circumscribed masses; in one or two similar places were small quantities of yellow blood-pigment. The spleen was not obviously unnatural in size or appearance; it weighed 5 ounces and was slightly soft in texture. Sections made after hardening presented, however, an extraordinary quantity of blood-pigment, scattered through the proper tissue and collected along the edges of the fibrous septa. The pigment masses were of deep yellow colour, and of very various, often large size, as seen in the woodcut, page 1179. The kidneys weighed together 10 ounces; they were typically white and fatty both on surface and in section, pale buff, greasy, and bloodless. The epithelium was extravagantly fatty, the cells swollen with oil-globules, so that they looked almost as if they belonged to the liver. In the cones were several white specks, as large as mustard seeds, which looked like old abscesses, though under the microscope they showed only fatty cells of somewhat indeterminate character, possibly epithelial, possibly altered pus or white corpuscles. Upon the pelvic membrane were spots of ecchymosis. After hardening sections displayed numerous small tracts of extravasated blood-corpuscles; these were little more than punctiform to the naked eye, but with the microscope presented the appearance of somewhat extensive regions of corpuscles, in some instances surrounding the malpighian bodies outside their capsules, and in others lying interstitially in connection with the cones, and on the outer part of the cortex immediately beneath the capsule of the organ. Some of these minute extravasations consisted chiefly of red corpuscles, of which the colour was retained, others mainly of white. (See woodcut, p. 1179.) Many of the blood-vessels, especially in the cones, were stuffed with blood-corpuscles. In several of the tubes, both straight and convoluted, were granules of deep yellow blood-pigment. The tubes were otherwise natural, save that they were overfilled with swollen epithelium. There was no lardaceous change either in the kidney or elsewhere.

Several of the joints were opened for evidence of pyæmia, but none found.

This case presented a complication of typhoid with malarial fever, not an unknown concurrence; which diseases appear to have attacked the patient at about the same time, or simultaneously. In the middle period of the illness the symptoms of the latter were chiefly apparent, together with those of the hæmaturic affection which had succeeded upon it. The character of the hæmaturia was sufficiently characteristic of its malarial origin in the disintegration of the corpuscles, which, when the hæmorrhage was most profuse, was complete. The succeeding symptoms of local effusion and rheumatoid pain were probably, like the purpura, caused by extravasation of blood or its material, such as constituted the hæmaturia. Hæmorrhages in many situations are well known as results of the malarial influence, and the state of the organs as found after death gave numerous evidences of the process. Later, the dropsy evinced a condition of ordinary nephritis, secondary, no doubt, to the disturbance of the kidneys by the evacuation. The effect of cold was not prominent in this instance; the cases of Dare and Rose Baker furnish instances in which the hæmaturic discharge began and continued independently of any such external agency. The beneficial effect of quinine in this case, as in the others, was sufficiently noticeable; all hæmaturic symptoms had subsided before the death of the patient, and indeed it may be presumed that recovery would have taken place but for the perforation, which was probably a late result of the typhoid.

Intermittent hæmoglobinuria in a child, contracted near the Thames, but without evidence malaria.

Ellen Collingbourne, aged 3 years and 2 months, was kindly sent into St. George's Hospital to be under my care, by my colleague, Dr. Ewart, under whose notice she had come as outpatient. She was admitted on November 22, 1883. She was born in, and had never left, London. She lived in Besborough Street, Pimlico, about 150 yards from Vauxhall Bridge, on the ground floor. Her mother knew of no ague, nor of any illness similar to the child's, in the neighbourhood. On November 22 of last year, exactly a year before her admission, she had her first attack of hæmaturia, together with nasal catarrh. The urine for a time was nearly black. Since then the hæmorrhage has recurred, according to the mother's statement, about once a fortnight, the largest interval having been in the summer. The attacks, on the same authority, present themselves in this wise. The child shivers, looks very cold, is cold to the touch, and turns all colours, the face and lips white, the finger-nails blue. The shivering lasts about ten minutes: she gets better on being well wrapped up, but does not sweat. The first urine passed after the rigor is black, and it so remains for the day, resuming its natural appearance on the following night. The attacks never came on in bed nor in the house, but only when she had been out in the cold. No periodicity was noticed. Since the disorder began she has lost flesh, and the skin has been yellow from time to time.

Attacks commonly due to cold

She was brought to the hospital in an omnibus; the day was rather cold, but she did not appear to get chilled. On admission she was somewhat anæmic, the liver could be felt a little below the ribs, the spleen not. Before and behind both lungs crackling bronchitic sounds were audible. Some dark urine, which had been passed before admission, which was very characteristic of her disorder, was brought with her; and after she had been in the hospital five hours some more was passed which was equally so. Later in the day the urine resumed its natural appearance, excepting that it was lithatic. Reserving the observations on the urine to be placed together subsequently, the child was kept without medical treatment and remained quiescent until November 28, when she was sent out for a quarter of an hour, and returned without having experienced any ostensible chill. On her return the hands and feet were found to be cold; the temperature in the axilla went up to 100·6°, and the breathing was somewhat quickened. Two hours later she again passed dark water, but not so highly coloured as formerly. The water resumed its natural appearance in the evening. On the 29th she was placed in a warm bath, taken out and dried before the fire, being carefully protected from cold. The urine first passed after the bath was normal; some passed $6\frac{1}{2}$ hours afterwards, and some more than $1\frac{1}{4}$ hour later, were black, the temperature at the same time rising to 99·4°. The mother had not known hæmaturia to follow a bath, excepting on one occasion, and then not

Attack sequent upon warm bath.

until the following day. On December 1 there was a brief recurrence of the hæmaturia, without known exposure or any appearance of chill. On this day she began to take quinine, a grain every 6 hours, which was gradually increased to twice the equantity, to be finally discontinued on the 19th, for reasons which will be subsequently stated. On December 4 another attack occurred without hæmaturia. The child was washed all over with warm water in the morning, and immediately afterwards the fingers, thumb, nails, and part of the dorsum of the left hand became purple and cold. At the junction of the discolouration with the healthy skin were a few irregular purple patches. Dr. Hewitt, the house physician, who witnessed this change, which I did not, had the limb wrapped in cotton wool, and in three hours the discolouration had entirely disappeared. On December 18, without any fresh recurrence of the disorder, the child was found to be extremely feverish, with flushed face, rapid and harsh breathing, and lithatic urine. On the following day a well-marked general eruption appeared, which was regarded, without hesitation, as that of measles, and the eyes were watery. Severe bronchitis set in, followed by signs of bronchopneumonia of both bases, and then by ulceration of the tonsils, bloody discharge from the right ear, and much laryngeal dyspnœa, under which she sank on December 26.

Another attack after washing in warm water. Great discolouration like that in Reynaud's disease.

Intermittent measles, which proved fatal.

When each attack made itself manifest in the urine this assumed a dark colour, which varied somewhat on different occasions, assuming that of brown sherry, porter, or black coffee; it was at first turbid, but on standing deposited a light-coloured sediment, leaving the upper liquid dark, but bright and clear. The discolouration lasted for one or two urinations; the urine then became lithatic, and then pale, clear, and natural. The urine under the attacks gave, with heat and acid, an albuminous coagulum of from one-eighth to a sixteenth. In the intervals it was quite free from albumen. The guaiacum test gave evidence of blood, while the urine was discoloured; none in the intervals Standing with strong hydrochloric acid, a thick indigo pellicle was at all times produced. The discoloured urine was examined with the spectroscope by Mr. Donkin on several occasions, with the constant appearance of the two bands of oxyhæmoglobin. The microscope showed during the attacks the characteristic brown sediment, more or less involved in a faint structureless translucent web, such as has been described with

Urine.

reference to other cases. There were small granular and hyaline casts; no crystals of any kind. Not a single blood-corpuscle was at any time discovered. The specific gravity of the urine varied: when discoloured, from 1017 to 1025; when lithatic, from 1025 to 1029; when natural, from 1014 to 1025.

Some chemical estimations made at different times are appended.

Post mortem examination.

On post-mortem examination small patches of recent lymph were found upon the pleura covering the lower lobes of each lung, while the lobes themselves were extensively hepatised so as to sink in water. Each tonsil was ulcerated and covered with a whitish slough; the epiglottis was œdematous; the mucous membrane of the trachea injected, velvety, and covered with mucus. No false membrane was to be found anywhere. The liver was full of blood, but in other respects appeared to be natural, and subsequent microscopic examination failed to reveal any further abnormity. The spleen presented a natural appearance to the naked eye, and also on microscopic examination.

The kidneys weighed four ounces. They were smooth externally; the capsules not adherent. On section they showed general injection which was most marked at the junction of the cones and cortices, where it was so intense as to give to the naked eye the appearance of extravasation, which minute examination proved to have taken place, though to a limited extent. Hardened sections showed general injection of the larger arteries and veins, as well as of many smaller vessels among the tubes, and of about the same diameter as they. In the cones groups of such injected vessels, parallel to and of about the size of the straight tubes, were disposed among them at regular intervals. But the most striking morbid appearance was an irregular mass of extravasated blood, of which the diameter was three or four times that of a malpighian body, in a torn cavity of the cortical tissue. Parts of this had wedged their way between the straight tubes, while in others the extravasation had become intimately mingled with dislocated convoluted ducts. In the greater part of the mass corpuscles could be distinguished; in part there was a mere blood-tinted granular débris: whether the corpuscles had broken down before or after exit, it was impossible to be sure; but it may be said that the granular débris bore a great resemblance to what was seen in the urine during life, and that blood-corpuscles extravasated as such, do not quickly lose their

Analyses of Urine of Ellen Collingbourne. Age 3 *Years,* 2 *Months. Weight* 1 *Stone* 10$\frac{1}{4}$*lbs.*

Date	General Description	Quantity, C.C.		Re-action	Specific Gravity	Al-bumen	Urea		Phosphoric Acid		Chlorine	
		Quantity referred to	Quantity for 24 hours				Per Cent.	For 24 hours.	Per Cent.	For 24 hours	Per Cent.	For 24 hours.
Nov. . . 22	Black, highly sanguineous urine passed at 6.30 p.m.	130	—	Slightly acid	1024	Much	2·2	—	·21	—	·56	—
„ 22 and 23	Urine first lithatic, then natural in appearance passed during remainder of 24 hours	260	—	Fully acid	1019	0	1·55	—	·15	—	·21	—
„ 22 and 23	Whole urine for 24 hours, including two preceding observations.	—	390	—	—	—	—	6·8	—	·66	—	1·26
„ 24 to 25	24 hours' urine during intervals of attacks, apparently natural.	—	360	Faintly acid	1025	0	2·26	9·36	·13	·46	·53	1·9
Dec. . . 1	Dark, intensely bloody urine passed at three urinations.	165	—	Faintly alkaline	1025	Much	2·5	—	·13	—	·57	—
„ . 2	Lithatic, not bloody, urine passed at three succeeding urinations, completing 24 hours.	160	—	Fully acid	1029	Trace	3 9	—	·26	—	·45	—
„ 1 and 2	24 hours' urine, including two preceding observations Trace of albumen in one urination only.	—	325	—	—	—	—	10·3	—	·62	—	1·66
„ 2 and 3	24 hours' urine, lithatic, but otherwise natural. (There had been an attack of hæmaturia in the preceding 24 hours).	—	340	Acid	1026	0	·26	8·84	·075	·255	·507	1·72
„ 3 and 4	24 hours' urine, clear and natural in appearance.	—	550	Acid	1015	0	1·9	10·4	·1	·55	·357	2·06

character. There were other evidences of extravasation which appeared to be chiefly arterial in origin. Blood-corpuscles were found outside a considerable artery. In several cases the outer sheath of such a vessel, or the connective tissue between the vessel and the tubes, was infiltrated with blood-coloured material, in which granular matter could be detected which may have consisted of disintegrated corpuscles. And finally an empty cavity, fringed with broken tubes and vessels which had been clearly made by ante-mortem violence, and could hardly have resulted but from extravasation. This was from four to five times the diameter of a malpighian body. All the results of extravasation which have been described were at or close to the junction of the cortex and cones. The tubes and malpighian bodies in general were natural.

Comments.

This case is of interest, especially as regards the post-mortem examination. The extravasation, and the results of extravasation, within the kidney were sufficiently distinct, though the hæmorrhage had been of less bulk than in the case of Evans previously related. The symptoms and course of the disease were much according to rule; they appeared to have had little to do with the fatal conclusion, which may be regarded as accidental.

Intermittent hæmoglobinuria appearing under malaria in a man who had had ague. Injurious effect of mercury. Intercurrent pneumonia. Recovery under quinine and iron.

I have not thought it necessary to reproduce, save in the briefest fashion, a case which I published in the 'Medico-Chirurgical Transactions' for 1865, to which I have more than once adverted. The man, who denied ever having had syphilis, contracted tertian ague in Lincolnshire fourteen years before he was attacked with the hæmaturia. This came on at Broadmoor, where ague was then prevalent, and occurred at irregular intervals under the influence of cold for six years. After furnishing in St. George's Hospital evidence of the injurious effect of mercury, under a salivating course of which cold was found more readily to produce the attack, he was seized with pleuro-pneumonia (the result of cold as he thought) and nearly died. He finally recovered under quinine and iron, and left apparently well in April, 1865. I last saw him in March, 1869. He was then forty-six years of age. He was, as he had always been, somewhat yellowish and anæmic, but he declared himself to be in perfect health, and stated that he had never had the slightest return either of the shaking or the hæmaturia. He had been fully exposed during three winters as a bricklayer. The urine was found to be perfectly natural.

Hæmoglobinuria excited by cold; no rigors; suspension of attacks under quinine; intercurrent synovial swelling.

The following example of the disease is peculiar in the absence of shivering, as well as in the presence of articular swelling. Rose Baker, nine years of age when first admitted into the Hospital for Sick Children, had always lived in London or at Haverstock Hill, and had never been, so far as was known, exposed to the influence of malaria, excepting that once she spent two days at Oakley Green in the valley of the Thames, where ague was existent, though she was never attacked by it. No peculiarity was noticed about her until the December of 1873, when, having been out on a frosty day, it was noticed that her back was cold, and on the following morning she passed water of the colour of dark port wine, consisting, as her mother inferred, chiefly of blood. It contained no coagula. She had had no pain or shivering. During the next week or two she repeatedly passed water of this character, and was brought to the hospital as an out-patient under Dr. Cheadle, by whom she was remitted to my care as an in-patient. She was kept for a fortnight without any appearance of the symptom, which, however, occurred immediately upon her dismissal. With the warm weather the hæmaturia ceased.

In November, 1874, she again began to pass bloody urine, after going out of doors, often only for one discharge. These attacks were without shivering, but were preceded, as the mother noticed, by a purple tinting of the lips and yellowness of the conjunctivæ. By these signs she could foretell, as she asserted, the forthcoming discolouration of urine. Recurrences of this nature were frequent all through the winter, and ceased on the approach of summer.

In the October of 1875 she again came under notice, with much the same symptoms. She had been out one day which the mother did not remember as particularly cold; on the next passed blood-coloured urine, and on the third was brought to the hospital. For three days she passed water of the same character. She had no lumbar pain, nor any shivering, but had a yellow tint of skin, much aspect of prostration, with a pinched face and sunken eyes. Under perchloride of iron and the protection of the hospital she soon recovered her ordinary health. On the 15th of the following January, which was frosty, she was sent out in the afternoon, and on her return again passed blood-stained urine. It was now of the deepest brown by reflected light, of a strong carmine tint by transmitted. It was albuminous to a quarter, and gave a trace of reduction to the copper test. On the next day the characters of the urine were almost the same. By the third it had lost the albumen and nearly recovered its normal colour. Reserving a more minute description of this secretion, and keeping for the present to the less technical character of the case, it was now found that the spleen could be felt below the ribs, not extensively but decidedly. Upon the suggestion of a malarial influence thus afforded, it was determined to try the effect of quinine, and on the 24th of this month two grains were ordered three times a day, in addition to the perchloride of iron previously in use. Early in February, in cold weather, but without definite exposure or marked commencement, occurred another attack similar to the last.

On the 15th of this month the child was observed to limp with the left foot, and on examination a swelling was found in the upper synovial pouch, of a consistency suggestive of an effusion of blood. The joint was not painful, tender, or discoloured. It was not hot, nor was the temperature of the body raised. By March 6, under the influence of rest and time, the swelling above the patella had disappeared, though there was still some general fulness of the joint as if from thickening of the synovial membrane.

The quinine was now increased to three grains three times a day, the perchloride of iron being continued as before. For a time she had no further attacks of her special ailment, though more than once sent out in severe weather by way of test. In May she left the hospital apparently well; and though kept more or less under observation since, she has hitherto (January, 1877) had no return of the hæmaturia.

I now lost sight of her until December, 1883, when I recognised her as an out-patient who had been kindly transferred to me by Dr. Ewart. The disease had recurred shortly after the last note, and she had had occasional attacks in cold weather, the last five weeks back. The quinine was at once resumed, and there had been no return when I saw her last—April, 1884.

The temperature was regularly observed and recorded for the whole time the patient was in the hospital. It was tolerably even throughout, with rather a low average. During the whole course of the disorder it never touched 100°, while it frequently sank as low as, and sometimes even below, 97°. As no rigors occurred, so there were none of the violent oscillations of temperature by which these are accompanied. The fits of hæmaturia were not associated with any rise of temperature; it was usually noted that during their continuance the thermometer was at its lowest.

I have reserved for a single description the observations which were made upon the urine at different times. At the height of an attack it was turbid and had a dark-reddish-brown colour. This on standing deposited a heavy sediment, which occupied about a fourth of its bulk, and had a remarkable olive-green tint, leaving the supernatant fluid perfectly bright and clear, and usually of some shade which suggested a vinous comparison. At the deepest it was fine burgundy, sometimes old or tawny port, and occasionally almost exactly the tint of dark madeira. This superior stratum gave a heavy deposit with cold nitric acid undistinguishable with this test from ordinary albumen. On boiling, it gave a large flocculent precipitate likewise like albumen; but this, if treated while hot with a drop of nitric acid, almost entirely dissolved. Liquor potassæ gave no deposit. With guaiacum and ozonic ether, it yielded the deepest blue. The sediment examined with the microscope gave a delicate yellow or reddish-yellow tint. It was minutely granular, presenting the appearance of the finest dust held together by a translucent gelatinous-looking web or matrix, in which no structure could be discerned. This imbedded, beside the granular matter, crystals of triple phosphate.

The urine, when the attack was subsiding, was bright, clear, of a vivid burgundy or old port colour, and quite without settlement or turbidity; this shortly fading to paler shades, and finally to the natural brightness and colour of healthy urine, by which time it had ceased to give any precipitate with heat or acid, or to respond to the guaiacum test. The apparently natural urine displayed a large excess of blue pigment on the action of hydrochloric acid.

Excision of wrist remotely followed by hæmoglobinuria; the attacks protracted and attended with little

By the kindness of Sir W. Jenner, I was enabled to see a patient of his in the University College Hospital who was suffering from the disease, and supplied with the excellent notes of the physician's assistant.

John Dare, 34 years of age, a carpenter, was a native of Devonshire, though long resident in London, latterly at Haverstock Hill. Here he was when attacked, and still resides. He never had ague, though, in answer to my inquiry, he said that febrile action. Thrombosis of femoral vein. Blood-crystals in urine.

he had heard of ague in his neighbourhood; and it is to be noted that Rose Baker, whose case has been related, also came from Haverstock Hill. In the year 1863, John Dare wounded his left hand with a chisel, and ultimately had to submit to excision of the wrist. Before this accident he had never had a day's illness, but afterwards did not quite regain his former strength. He, however, observed nothing of his latest disorder until the year 1874, when he caught cold; had the symptoms of ordinary catarrh with cough, and then for the first time noticed that the urine was black, which appearance it retained more or less for fourteen days. Neither was this attack nor any subsequent one preceded by shivering, though on other occasions, as with this, it succeeded upon a sense of having caught cold and a feeling of general malaise. In the winter of 1875 the same symptoms recurred; the urine became black, and remained so, with intervals of partial improvement for three weeks. The next winter brought a third attack of the same kind, with the addition of œdema of the legs—a condition which was still present when he came under the care of Sir W. Jenner on January 1, 1877.

Six weeks before this the urine had again become black, with pain in the loins and increase of œdema. On admission there was much pallor of the skin and mucous membranes, while the conjunctivæ, and also the skin, had a slightly yellow tinge. The left leg was enlarged and œdematous nearly to the groin; below the knee was an old ulcer extensively, but not completely, cicatrized; in the position of the femoral vein in Scarpa's space a hard cord was felt, which was apparently the vein thickened or obstructed; and near Poupart's ligament was an indurated lymphatic gland. The right leg was not now œdematous; upon it were the marks of old ulcers. The cardiac dulness was somewhat increased, and the sounds distant, though free from murmur. It may be remarked that a systolic apex murmur became afterwards audible. No enlargement of the spleen could be detected, nor could the liver be felt below the ribs. On deep palpation the kidneys, it was thought, could be felt as somewhat larger than natural. There was no frequency of micturition. The urine was high-coloured and clear, though in it floated a flocculent deposit, in which mucus and reddish-brown pigment granules were displayed by the microscope. There was neither albumen nor sugar.

The swollen leg was raised with pillows and poultices applied over the rigid vein. On January 13 a tender and red spot was noticed over the junction of its lower and middle thirds.

On the morning of the 16th the patient appeared to be feverish, though the temperature when observed at the usual hour was only 99·1° ; the face was flushed, the eyes suffused, the bowels confined ; he thought that he had caught cold, and was about to have a return of the hæmaturia—an anticipation which was realised on the following morning by the passage of porter-coloured urine, albuminous to a quarter, with a considerable amorphous sediment, consisting of urates with dark-brownish-yellow granules, and a few casts for the most part made up of the same material. No blood-corpuscles were visible. There had been no shivering, nor was the morning or evening temperature raised. The character of the urine remained the same until the evening of the 18th, when it had almost resumed its natural colour, though a slight deposit, such as before, could still be detected, and it was still albuminous to the extent of an eighteenth. The patient had now nearly recovered his former health, and the tenderness about the femoral vein was much less.

On the 26th quinine was begun. Hitherto the patient had been taking a little perchloride of iron three times a day : two grains of quinine were now added to the mixure.

On the evening of the 28th a similar feeling of illness foretold the approach of another attack, and during the night black urine, such as before, was again passed, with accompanying relief to the general symptoms. The urine did not resume its normal appearance until February 2, when the pigmental deposit was replaced by amorphous urates. A faint trace of albumen was still perceptible. The interval of health, however, was short, for the next day the nausea returned, and the urine again became charged with the chocolate deposit.

Some passed on the 5th was kindly forwarded to me : it had the appearance of lightish turbid port wine. On standing it deposited a sediment like that of beef-tea, having the upper structure bright and clear like brown sherry, or nearly that of Vogel's seventh tint. The deposit under the eighth (900 D.) resolved itself into a collection of yellow vitreous-looking masses, which exactly resembled the blood-crystals often seen in the brain and elsewhere, entangled in a transparent shapeless web, of which the material resembled structureless mucus, or the fibrinous basis of a hyaline cast. The crystalloid specks were dissolved by liquor potassæ, not by acetic acid: the colourless web by both. The urine coagulated by heat to a twelfth, the coagulum, while hot, being largely dissolved by nitric acid.

The quinine was now increased to three grains, and two days later to five grains three times a day, and the iron discontinued. From this time he had no attack, and by March 3 had so much improved in general health that he was well enough to be made an out-patient. He was still sallow, but had improved in flesh and strength, and passed urine which was natural, save that with the microscope a few coloured granules could be detected. He was kept under smaller doses of quinine, and for a long time had no return of the disorder. In the April of 1880, however, he was in St. George's Hospital with a recurrence of the symptoms which have been described.

The temperature night and morning ranged from 98·4° to 99·4°, exceeding the higher limit only on a single evening, when it touched 100·2°.

In this instance it would seem that there was an unusual absence of febrile action—the temperature was almost normally constant, and none of the attacks were preceded by rigors. The disorder, indeed, presented itself in a sluggish mood; its periods of onset little marked constitutionally, and each attack more than commonly protracted. The feeling of malaise, or general illness, appeared, as in many other instances, to have very distinctly preceded any change, either in the sensations or the secretion of the kidneys.

Hæmoglobinuria preceded by syphilis and ague. Cessation of attacks under iodide of potassium.

Patrick Nelis, aged 46, was admitted under my care in St. George's Hospital, on November 3, 1877. He had been in the army and the tropics. He had had a venereal sore 17 years back, had had dysentery, and had suffered severely and repeatedly from tertian ague; the last attack of which was still on him at Woolwich, in 1866, when, according to his statement, he first occasionally passed red urine. When in St. George's in 1877 his chief complaint was of rheumatoid pains, chiefly syphilitic. On several occasions without noticeable exposure or any declared febrile action, characteristic urine was passed. It had a full claret colour, was albuminous, contained no blood-corpuscles, but deposited a sediment of light brown powder with granular casts and a delicate translucent film which imbedded sparkling yellow specks apparently blood-crystals. The urine, on getting up, was usually natural, as also was that passed in the evening; the dark urine presented itself in the middle of the day infrequently and apparently capriciously without any obvious cause or periodicity. Lithates and oxalates were frequently present. Under iodide of potassium the hæmaturia ceased to recur, and he left the hospital apparently well on December 19. He was re-admitted in the following March in a state of dementia. It was stated by his wife that there had been no recurrence of the hæmaturia.

Intermittent hæmaturia with intemperence and syphilis. Attacks at first uncertain in origin, but afterwards distinctly incited by cold. Characteristic urine. Recovery under quinine.

Edward Harvey was born at Newmarket, but brought to London at the age of 2, where he has since remained, excepting that 5 or 6 years before his admission he spent a few days at Boston, in Lincolnshire. He has frequently had venereal sores and once a suppurating bubo. Excepting these affections he remained well in health until Christmas, 1877, when he had some glandular swellings in the neck, and soon afterwards began to suffer from chilliness, feeling cold, but not shivering. For several nights he slept with his clothes on and, always being a free drinker, endeavoured to keep himself warm by potation, taking, as he stated, from 30 to 40 glasses of hot rum and water in the day, or from 3 to 4 pints of the spirit. On the third day of this regimen being inebriated, but not incapable, he went outside the public-house where he was to pass water, which he observed for the first time dark, like rum. It so continued for 9 days. He had no special exposure to cold, nor any shivering, though he felt chilly, weak and ill, and his friends observed upon his sallowness. He kept about as usual, but on the 11th day, without any treatment, excepting several half-pints of beer on the preceding evening, the water was found to be natural in appearance. On this day the patient was, according to an arrangement previously made, admitted into King's College Hospital, where he remained for 11 days, during which the urine continued normal. He left on a bitterly cold day, and within ten minutes of going out into the wind again voided urine which was nearly black and so continued for 2 days. This was the first definite association of the urinary change with external cold. He had several similar experiences in which after exposure he became cold and passed black urine, though as yet he had no rigors. When thus affected he used to go home, wrap himself up, drink something warm, and soon the urine became light and clear and himself as before. On March 9, 1878, he was seized with a violent rigor and the urine again became dark. From this time until his admission into St. George's Hospital the rigors recurred with violence daily at almost exactly the same time. It was his practice to commence his work out of doors at 12 o'clock, and the rigor always came on within half an hour of this time. He stated that however freely he exposed himself to cold in the evening this result did not occur. Later, as will be seen, the symptoms were incited by the same means in the evening as well as in the morning. Each rigor was such as to shake him, as he said, from his feet to his teeth. His custom on their occurrence was to go home and sit before the fire, or cover himself with clothes and drink hot beer or tea, after which he got into a dry heat but did not sweat. The urine passed during and soon after the rigors was dark brown or nearly black, but became light again in 3 or 4 hours.

On March 23 he was admitted under my care at St. George's Hospital. He was then 27 years of age. He had worked as a plumber and painter since the age of 14, but had not had, as far as could be ascertained, any of the ordinary plumbic disorders, nor was there any blue line. His complexion now was not especially yellow or sallow. The liver was enlarged to an inch and a half below the edge of the ribs; the spleen gave no evidence of increase. He had some pains in the loins and epigastrium, and complained of an eruption like nettle rash, not always present, but appearing as white raised patches, especially on the first exposure to cold in the morning on getting out of bed. This was attended with slight itching. The urine at the time of admission was deeply blood-stained and highly albuminous, like what is subsequently described; that passed next day was highly albuminous, but not blood-stained; on the day following it was natural in all respects.

April 1. There was no recurrence of the disorder until April 1, when, the wind being east and bitterly cold, he was sent out for a walk. He did not appear to feel the cold much, nor did he shiver, but an hour after his return he passed water which was nearly black. On standing twenty-four hours this divided into two parts: the upper four-fifths clear, but very dark, almost exactly of the deep, dull red of the garnet; the lower fifth much lighter in colour, consisting of a pulverulent sediment of almost exactly the shade of the new red sandstone. The superstructure gave a precipitate of one-third with heat, which the addition of nitric acid did not perceptibly increase or diminish. Acetic acid gave no immediate precipitate, but after standing a decided one, probably uric acid. Carbonic acid passed into the urine, diluted with an equal volume of water, gave a precipitate in dark flakes much less bulky than that caused by heat. Shaking with animal charcoal entirely removed the colour, so that the liquid became as transparent and colourless as water, and it was found that by the same process it had also lost all its albumen but a faint trace. The sediment displayed under the microscope a brown deposit which, save that it was in fine powder, was amorphous. Two or three crystalloid particles could be discerned, apparently blood-crystals. Many hyaline casts were seen which had the same brown colour as the granular sediment. There were no blood-corpuscles, nor was the fibrinous web seen in other cases noticeable. The deposit is shown in a woodcut at page 1172. The colour of the urine diminished with each successive urination for five and a half hours, at the end of which time it was perfectly natural in appearance.

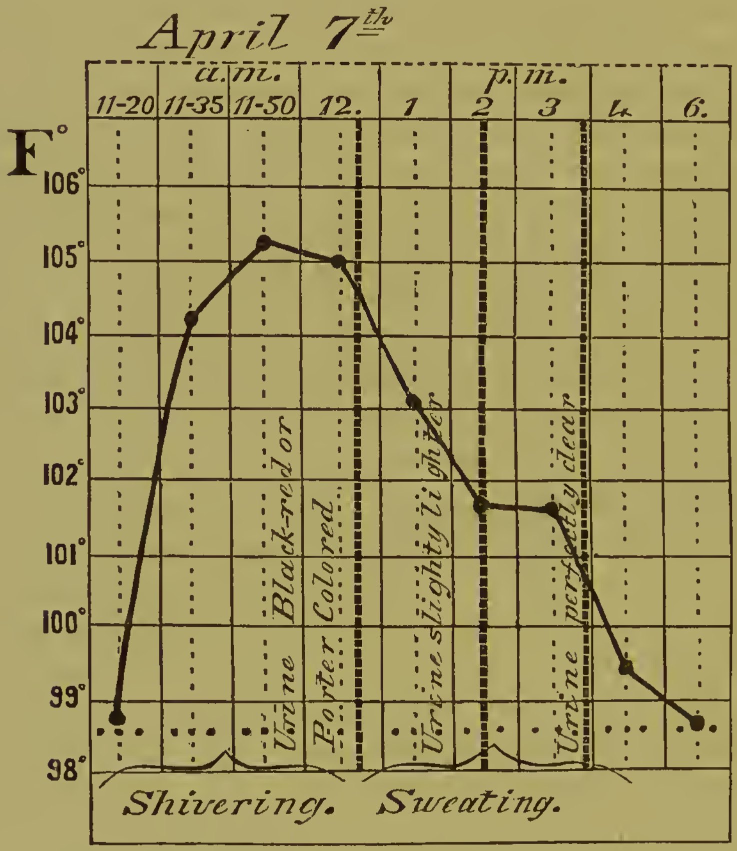
Next day much the same series of events took place, with the addition of a rigor. In the evening the patient went to the water-closet, came back cold and shivering, passed black water as before, the secretion next day being of natural colour and free from albumen. The treatment had hitherto consisted in one administration of a mercurial purge: six grains of quinine were now ordered to be given three times a day. On the 5th, again after going to the water-closet, the rigor and hæmaturia recurred much as before. On the morning of the 7th, at 10.50, he went into the yard, and remained there for twenty minutes. When he came back he was feeling chilly, and the backs of the hands and arms were covered with urticaria. The temperature in the axilla was 98·8°. He now began to shiver, and went to bed; the shivering lasted for thirty-five minutes, the whole body shaking, and the teeth chattering. Soon after twelve he began to feel more comfortable, and at two broke out into a profuse sweat, which lasted two hours. When the rigor began at 11.20 the temperature was, as stated, 98·8°; at 11.50 it had reached its maximum 105·3°; from this it gradually declined until six o'clock, when it had come back to 98·8°. Black urine was passed

April 2.

April 5.

at 12.30, when the rigor was passing off; at 2 urine which was less dark; at 4 urine which was natural in appearance.

From this date he had no return of the rigors or hæmaturia: the temperature remained for a time a little uneven, once rising as high as 101·9°, but it gradually became normal. On April 27 he displayed the symptoms of periostitis of the head of the radius, clearly syphilitic, in consequence of which iodide of potassium was added to the quinine. His recovery became complete, and on May 27 he was sent to Wimbledon convalescent.



Temperature during attack of intermittent hæmaturia in case of Edward Harvey, from observations made by my clerk, Mr. Evelyn Rich.

Intermittent hæmaturia. No history of ague or syphilis. Intercurrent diphtheria. Arrest of

Alfred E. Stone, five years of age, admitted into Hospital for Sick Children November 20, 1878. No history of ague or syphilis: lived in Kentish Town: no ague known of in the neighbourhood. The first symptoms of the complaint were noticed last Christmas, when he used to become drowsy, wake up cold, and then pass dark water, which would remain so for two or three days, and then be right for several weeks. He soon ceased to be thus affected, but became so again three months before admission.

attacks under quinine.

The first urine in the morning was always clear and bright; the later urine sometimes dark for two or three days together, and when so was passed with frequency. No shivering had been observed, nor any feverishness, save on one occasion. There was increasing pallor and some yellowness. The conjunctivæ were not jaundiced. He had a slight prolongation of the first sound of the heart at the apex. The liver and spleen were not to be felt. No tenderness in the renal region. While in hospital (three and half months) he had eight attacks, with which there was scarcely any other symptom. There was no shivering, nor any alteration of temperature. This ranged somewhat more widely than in health, though usually between 97° and 99°; but no increased variation with the attacks was observable. These were generally due to some traceable exposure, going out on a cold day, running about while being washed, and such like. The change was usually brief—perhaps the morning urine bloody, the evening natural. The altered urine when first passed was turbid and nearly black; on standing it separated into two parts: a clear but deeply-coloured supernatant five-sixths or six-sevenths, which was almost black by reflected light, but clear, bright, and of a rich garnet colour with transmitted light. This was many shades darker than the same volume of port wine. The lower sixth or seventh consisted of a powdery sediment much lighter in colour than the clear liquid, about that of the colour known as raw sienna. The urine gave with heat and acid an albuminous clot, which varied on different occasions from four-fifths to one-fifth. The clot with heat was sometimes considerably diminished by nitric acid; not always so. The microscope showed the sediment to consist of amorphous yellowish powder, casts imbedding the same, a few globular cells like pus, and a delicate translucent, apparently fibrinous expansion, in which casts and powder were imbedded, besides some strongly-marked refracting specks, apparently crystalline, but too small to identify. (See wood-cut, page 1171.) No blood-corpuscles were ever seen. In the intervals of the attacks the urine was perfectly natural.

While under observation before any special treatment was begun, he had an attack of diphtheria, due probably to infection, and passed favourably through it, much as any other child might have done. He had no hæmaturia under the intercurrent disease, but a severe attack on the first exposure with convalescence.

Upon this, in January 3, he was put upon three grains of quinine three times a day. On the 4th, 7th, 18th, and 25th he had slight recurrences from recognised exposures. On the latter date the quinine was increased to five grains three times a day. From this date until he left the hospital on April 4 he had no return, though he was sent out on some very cold days. Once in the following month a slight relapse occurred. I have not heard of him since.

Exposure to malaria, hæmorrhage protracted; not definitely traced to cold nor periodic. Quinine.

Patrick Madden, twenty-eight years of age, was admitted under my care at St. George's Hospital on April 9, 1879. He had habitually suffered from swollen and suppurating glands in the neck, but in other respects had good health. For the last seven years, until three weeks ago, he had lived at Barking, in Essex, in a marshy district, two miles from the river. He never had ague, though the neighbourhood is notoriously malarious. There was no history of syphilis. He had at times drunk hard. His occupation in summer was that of a bricklayer; in winter he was a journeyman baker. He was quite well until six days before admission, a fortnight after leaving Barking, when he was attacked, without any cause which he could assign, with headache and shivering; the latter repeated several times in the day. He noticed at the same time that the urine was black. He had a second attack of the same kind on the morning of admission. He looked ill; the tongue was coated, and the bowels confined. There had been no pain excepting headache. The urine, when first passed, was like porter; on standing a light brown sediment fell, leaving the upper part with much the appearance of port wine. It was acid; had a sp. gr. of 1010, and was albuminous to one-sixth. The sediment consisted of amorphous granular matter, amongst which, after some search, about half a dozen red blood-corpuscles were detected. There were many casts containing the same brown granular material, and many epithelial cells, both from the kidneys and urinary passages. He was kept in bed, freely purged, and quinine given at the rate of twenty-four grains a day. There was no such rapid cessation of the hæmaturia as in most cases, though day by day the colour became less dark, through shades like strong and then weak tea, and the albumen less abundant. On the 21st the blood tint was no longer apparent, though there was a trace of albumen, which was still present on May 5, when, without any recognised exposure or assignable cause, there was a return of the hæmorrhage, though not of the shivering. This attack was much less severe and shorter than the former, though the characters of the urine were essentially the same. By the 9th the discolouration had ceased, though there still remained a trace of albumen. By the 14th this also had departed, and the patient was apparently perfectly well, in which condition he left on the 17th. I have not heard of him since.

Intermittent hæmaturia immediately excited by cold and wet in an excavation near the Thames. Patient formerly exposed to malaria, but not known to have had ague. Spontaneous recovery.

Reuben Parker was born in the year 1832, and lived until he was six years old at a damp place in the neighbourhood of Worthing, where, according to his statement, ague was prevalent. He never had the disease, however, either here or elsewhere. He had syphilis in the year 1853. He served through the Crimean War in the Fusilier Guards, and afterwards became a labourer. His disorder began three weeks before his admission while digging deep foundations for a bank in Spring Gardens, apparently in the ancient bed of the Thames. The soil was sandy, and the pit in which he worked contained much water, which was kept down only by constant pumping. While here at work on a very cold day he had a severe rigor, with a sensation of intense cold, shivering in every limb, and chattering of the teeth. This condition, which lasted for two hours, was not followed by any perspiration, or even warmth; but the urine passed was like thick coffee. He had no pain in the back. At the same time several other men were taken ill with coughs and colds, but none in a similar manner to him, nor was there any ague among them. Since the attack described the patient had recurrences of the same kind two or three times a week, always passing dark urine after the attack; in the intervals urine of natural appearance. On November 28, 1878, he was admitted into St. George's Hospital by Dr. Whipham, who kindly transferred him to my care. While in the waiting-room he made water of the colour of port wine; it was loaded with albumen, and contained dark granular débris, and numbers of granular casts, but no blood-corpuscles. He was anæmic and sallow, and complained of sharp pain in the back like lumbago. There was a faint systolic murmur at the apex. The liver and spleen gave no signs of enlargement. He was purged with calomel and senna, and kept warm, under which measures the urine resumed its natural characters, and the rigors did not return. On

December 5 he was sent into the open air, and, after walking about for half an hour, came back shivering violently with cold extremities, blue nails and lips, and an axillary temperature of 100°, which in fifty minutes had increased to 103·8°. Under the rigor he passed urine which was not conspicuously abnormal, but contained a trace of albumen and a shade of blood-colour. An hour and twenty minutes after the beginning of the attack the shivering had left the extremities, which were no longer icily cold, though it was still felt in the back, and the temperature had fallen to 102·8°. A small quantity of urine which was now voided had a brownish-yellow colour, was albuminous to one-half, and deposited a sediment consisting of fine powder or granular matter which was imbedded in a translucent uniform web. Two hours and a half after the beginning of the attack it was apparently at an end. The patient was warm, but there was scarcely any perspiration. The urine was now lighter in colour, and contained only a trace of albumen. There was no recurrence so long as the patient was under observation. He left the hospital on January 8, having latterly been out every day in order to test the completeness of his recovery. He had no medicine, except the aperient on admission; quinine was withheld in order to ascertain how far he might recover spontaneously.

Syphilis but no ague. Malaria uncertain. Attacks characteristic. Suspended under quinine.

Fred. Taylor, aged twenty-eight, a draper's assistant; admitted into St. George's Hospital March 15, 1880. Born at Haverhill, in Essex; lived there until fifteen; since then in London, in Pimlico, near Victoria Station, where he was when attacked. No history of ague. Gonorrhœa, chancre, and eruptions six years ago. Stricture afterwards, which required occasional use of catheter. Three and a half years ago had retention; water drawn off looked like pure blood. In October 1878, while under treatment for stricture at St. Thomas's Hospital, began to have attacks of hæmaturia with shivering, which were often repeated, especially in cold weather. Dr. Stone, to whose care he was remitted, found the water under a paroxysm to be black and albuminous; to contain the débris of blood-corpuscles, granular cells, and oxalate of lime; to strike blue with guaiacum, and to give with the spectroscope at one time the double band of oxidized hæmoglobin, at another the single absorption band. In St. Thomas's Hospital the rigors and hæmoglobinuria recurred under cold, and were kept off by warmth, no other treatment being adopted.

He left St. Thomas's, and was admitted, as stated, at St. George's. He was anæmic, the face sallow and shrunk. He had an attack on the day of admission (March 15), in which the temperature went up to 103·8°. The first urine afterwards was black and albuminous; it contained granular matter; no casts, crystals, or corpuscles. The next was less coloured, and contained less granular matter, but a few red corpuscles. On the 17th the urine was natural in all respects. On the 19th six grains of quinine were ordered three times a day. Next day he had a rigor with a temperature of 103·8°, followed by sweating and the passing of black urine as before. With the granular débris a single red blood-corpuscle was found, and small casts containing granular matter. In fifteen hours the urine had lost all albumen, and was natural in all respects. From this time until he left the hospital he had no return of the hæmaturia, though once or twice on exposure he had slight chills; on one occasion amounting to shivering. While under treatment he had an attack of quinsy. The quinine, however, was only briefly interrupted; perchloride of iron was subsequently added, and on June 9 he left the hospital apparently well. I have not heard of him since.

Characteristic attack in a child who had been exposed to malaria. No recurrence under quinine.

Frances Le Dieu, aged five years and eight months, of somewhat weak intellect, was admitted into the Hospital for Sick Children under my care on August 5, 1880. For the previous six months she had occasionally passed bloody urine without shivering, pain, frequency of micturition, or any other symptom. The attacks were not periodic, nor had any association with cold attracted notice. The last was on July 31; the urine then passed was brought to the hospital on the day of admission: it was characteristic in all respects—presenting on standing a clear superstratum of a brownish-orange colour, which was albuminous to one-seventh, and a chocolate precipitate of a sixth the bulk of the urine, which chiefly consisted of amorphous granular material of a brownish-yellow colour, mingled with which were a few casts containing the same substance, a few blood-corpuscles, and crystals of uric acid.

The child had lived in Pavilion Road, Chelsea, until five months ago; latterly at Porter Street, Leicester Square. On two occasions she had spent three weeks at Hadlow, near Tunbridge, where two of her uncles had contracted ague.

On admission she was put upon quinine, which was gradually increased up to twelve grains daily. Under this and the protection of the hospital she had no return of the hæmorrhage, though the temperature was somewhat uneven, ranging between 97° and 99°. She left apparently well on August 26.

Supposed malarial illness. Scarlatinal albuminuria. Irregular attacks of hæmoglobinuria; their cessation or suspension.

Fred. S——, a clerk, aged twenty-five, was sent to me at St. George's Hospital by Dr. Henderson of Highgate, under whose care he had been, and admitted January 13, 1881. He said that, while living at Bow seven years before, he had had scarlatina, followed on one occasion only by the passing of porter-coloured urine. He soon after went to live at Buckhurst Hill, in Essex, in a low situation close to flooded meadows. He there had an illness which was described as malarial, which was attended with attacks of coldness, heat, and sweating, and with pain in and looseness of the bowels, apparently of a dysenteric character. He left Buckhurst Hill and went to Highgate, where, after having had good health for a year, he had, about two years ago, a second attack of scarlatina, which was followed by albuminuria in a severe form, from which he recovered after hot-air baths.

The present illness began four months ago with an attack of shivering after sitting in a draught, and the passing of porter-coloured urine for two days subsequently, with pain in the loins. Two months later he had a similar attack, and another nine days ago. The intermediate urine was found by Dr. Henderson to be natural. There was no history of gravel, but a little tenderness was found in the abdomen over the right kidney.

He was under my care in the hospital from January 13 to 29, during which time he had three slight attacks of shivering, with aching in the loins and legs, and sensations in the bowels; but no hæmaturia, save that the urine, which was natural in all other respects, showed one or two red blood-corpuscles with the microscope. He was somewhat anæmic, and was treated with iron and quinine.

On February 27 I received a specimen of urine which he had recently passed, which was highly characteristic of his disorder. It was dark-brown, and gave, with heat and a minute quantity of nitric acid, a coagulum of one-seventh. When acid was added equal to one-half the bulk of the urine, the coagulum entirely redissolved. There was a bulky settlement which consisted of dark-brown granular matter, casts imbedding the same material, and others containing epithelial cells, a few flat cells of epithelium, possibly from the pelvis, and a few red blood-corpuscles.

I last heard of him in October 1883, when Dr. Henderson informed me that the patient had apparently recovered under the combined effects of quinine, iron, and time, having had no return for more than a year.

Attacked at Bermondsey near the Thames, but no history of ague. Fits irregular, due to cold. Improvement under quinine.

William Jones, aged 48, admitted into St. George's Hospital February 15, 1883. He lived for his first eighteen years at Mildenhall, near Marlborough, a village on the Kennett among the chalk downs. He then moved to Bermondsey, and has since lived there in the same house, a quarter of a mile from the Thames. He there had three attacks of rheumatic fever, and became subject, thirteen or fourteen years back, to his present complaint. He never had ague, nor heard of it, either at Mildenhall or in Bermondsey. He was not known to have had syphilis. The first attack came on in the summer after getting wet, but the subsequent ones were always in the winter, in cold weather, and in the morning, he having no fear of them if he could get over this part of the day. They came on irregularly, sometimes daily, in continuously cold weather. When about to have one he shivers, feels 'queer about the head,' and giddy; his right hand and foot become cold, not so the left; he then has pain in the bowels, about the umbilicus, which appears 'to go right through him,' and has a great desire to pass water, which he does at short intervals and in small quantities for three or four times, the urine being dark-coloured. He endeavours at the outset of the attack to go to bed and get warm; he then sweats slightly, whether from the disease or external heat; usually goes to sleep and wakes up well, the next urine being natural in appearance. Under the attacks he often became, according to his own statement, as yellow as saffron. He had lost weight, and become pallid. No enlargement of the liver or spleen could be detected, nor was there any sign of organic disease, further than that the heart's impulse was somewhat extensive.

He had had an attack on the morning of the 15th before his admission, and brought the urine with him, which was nearly black, and had the characters presently described; the evening urine was lighter in colour, and loaded with pink lithates; that passed in the following morning was natural. He was put upon good diet, and 6 grains of quinine three times a day, which were gradually increased to 10 grains as often. Under this he had attacks, each of which was less severe than the preceding, on February 24, February 28, March 27, and April 5. All were due to recognised chills. The last attack was very short and slight.

The characters of the urine, once for all, were these. That passed under the attack, perhaps at two or three times in the morning, would be turbid and dark, like muddy port wine. On standing a bulky chocolate sediment would fall, leaving the superstratum bright and clear, which, on being compared to the port of the hospital, was found to be a shade lighter. The sediment displayed an abundance of yellowish-brown granules, mixed with casts containing the same coarse granular material; some epithelial cells from the bladder or pelvis, but no blood-corpuscles, nor any oxalate or other crystals. The urine was acid, albuminous to about half. The urine passed later in the day would be less coloured and less albuminous, but mixed with a quantity of red lithates; that passed next morning natural, or with only a trace of albumen. The urine then became natural in all respects, and so remained until the next attack.

He remained in the hospital until April 20 without further recurrence, and left, having gained flesh, colour, and general health.

No evidence of malaria beyond residence in Westminster. Occasional rigors. Discharge with urine independently of them. Cessation of attacks under iron.

Charles Bracy, 16 years of age, lived at Hammersmith, but was employed all day at the Meteorological Office in Victoria Street, Westminster, where he made extensive use of turpentine varnish. Putting aside the latter situation, he never lived in an aguish or marshy neighbourhood, nor ever was exposed, so far as he knew, to malaria. He was not known to have had syphilis. Seven weeks before his admission he noticed that his urine was dark in colour, especially on going to bed, that passed on getting up being usually natural in appearance. He had occasionally of late had slight shivers, but did not connect these with the change in the urine, nor was this attributed to cold. In his own view it was due to exercise. He consulted a chemist, without relief;

then applied as an out-patient at St. George's Hospital, and saw Dr. Ewart, who after a few days placed him in the hospital under my care. He was admitted December 20, 1882. He brought with him some urine which had been recently passed. This was highly characteristic; the supernatant part like clear but strongly coloured port wine; a heavy brown sediment, which consisted of dark granular matter, more or less entangled in a translucent film apparently of fibrine, and granular casts of the same material. No blood-corpuscles were found. The urine was albuminous to one-third. The patient was yellowish and very anæmic. There was a slight increase of splenic dulness, though neither this organ nor the liver could be felt. He complained of pain in the back and in micturition; of nothing else. When admitted the urine was natural. He was treated with perchloride of iron, quinine being withheld until the disorder should be ascertained to recur. He had a slight return of hæmorrhage, but no shivering, after having been sent out of doors on January 15, the urine passed on his return being of a dark sherry colour, albuminous to a sixth, and presenting all the characters which have been already described, but in a less degree. With this exception the urine during the whole of his stay was practically natural; it contained no oxalate, but on many occasions lithates and uric acid. He left in apparent health on February 10. I saw him frequently until April 27. He had had no discolouration of urine, though on one occasion he had had slight shivering. He had lost much of his anæmic look, resumed his occupation, and was apparently well. When last seen the urine contained a trace of albumen.

Characteristic attack two years after exposure to malaria. Recurrence ceased under quinine and iron.

Francis Hercock, a farrier, 42 years of age, lived at Battersea all his life, excepting 18 months which he spent at Waltham Abbey, in Essex, in the same house with a brother-in-law, who there contracted ague and at last died with it. He left there two years before admission; about a month after his doing so he had jaundice and passed bloody urine. For the ensuing six months he was rendered unable to work by repeated recurrences of hæmaturia, together with shivering and pain in the loins and thighs, which came on at irregular intervals, always after exposure to cold. They then ceased to return, he resumed work, and remained well until 17 weeks before admission, when he was seized with cold shivers, passed bloody urine, and continued to do so occasionally, until February 2, 1883, when he came into St. George's Hospital under my care. He has never had syphilis. He was exceedingly anæmic and sallow. A little fulness was detected in the hepatic region; the spleen was not to be felt, but its dulness was increased. The heart and lungs were natural. He had a large chronic ulcer on the right leg, and two on the left. He had passed while waiting some urine of the colour of new port wine, which coagulated with heat and acid to one-sixth. On standing the upper part became bright and clear, though still intensely coloured; a bulky reddish-brown sediment fell, which, when examined next day, chiefly consisted of amorphous granular matter interspersed with minute shining granules, coarse granular casts, and triple phosphate crystals. No blood-corpuscles were seen. Upon admission, the urine with each passing became less dark and less albuminous, until on the following forenoon it was nearly natural, and on the day after that quite so.

On February 3, 6 grains of quinine and 15 minims of the tincture of the perchloride of iron three times a day, and good diet, were ordered. He remained in bed chiefly in consequence of the ulceration of the legs, which was being treated surgically, but notwithstanding this he had four decided rigors during his stay in the hospital: on February 19, March 16, 17, and 23. These were attended with a rise of temperature for about 6 hours, the maximum in the several attacks varying from 101·3° to 103·4°. There was no hæmaturia. He was transferred to the surgeon for the ulcers on April 17. At this time he was taking 5 grains of quinine and 10 minims of the tincture of the perchloride of iron three times a day, which remedies were continued. On May 5 he got up, was exposed to cold, and had a slight return of the hæmorrhage, with a temperature of 102·5°. He left the hospital on the 19th, relieved as to the ulcers, and without any further return of the hæmaturia.

Intermittent hæmaturia sometimes without appreciable destruction of corpuscles; not traced to malaria

John King, a Jew, aged 27, an omnibus conductor, was sent into St. George's, under my care, by Dr. Ewart, to whom he had applied as out-patient, and by whom the nature of his disorder was detected. He was admitted on January 28, 1884. He was born in Kentucky, transferred to England and to Brighton at the age of six months, where, at the age of ten years, he was first seized with the pain characteristic of his attacks. There was no history of malarial exposure and none of syphilis. He has or syphilis. No recognised association with cold. Attacks attributed to excitement.

since lived in different parts of London and has had good health, excepting recurrences of his disorder, one occurrence of jaundice and one of gonorrhœa. The hæmaturic attacks begin with a dull aching pain, described as below the left ribs in the nipple line; it is very limited, not extending into the loin, thigh, or testicles. He takes to his bed when this pain comes on, and feels sometimes hot and sometimes cold, but does not shiver. The urine during the pain is clear and natural in colour, but about 24 hours after its subsidence presents the appearance of blood. It was not until seven or eight years ago that any urinary change was noticed in connection with the attacks. These recur mostly at irregular intervals, though for some time he had one weekly, on the same day, without any ostensible cause. There has been no ascertainable dependence upon cold, the attacks, indeed, are thought to recur more often in the summer than in the winter. They are brought on only, as far as he knows, by excitement, going to the theatre, seeing friends, and such like. He has often gone for several months without one. Eighteen months ago he married, and remained free for the ensuing four months. He has never passed stone or gravel. The last attack before admission occurred on January 16. The pain kept him in bed for one day; on the 17th the pain had gone and the urine was bloody. Some which was passed on the 19th was examined on the 28th. It was turbid, of the colour of light port wine; it contained a quantity of characteristic granular débris, many granular and hyaline casts, crystals of uric acid and oxalate of lime, numerous bacteria, no blood-corpuscles. There was a distinct flocculent precipitate with sulphate of magnesia, after the removal of which a much more bulky one with heat and acid. The urine passed on admission was natural; it contained no trace of blood or albumen. The patient was in good general health; no enlargement of the spleen or liver was found.

The patient remained in the hospital without treatment and without any recurrence of his complaint until February 27, when he was discharged, to return if his ailment did so. He came back on March 5, having had a slight return. The urine was now scarcely tinted, though a deposit of blood was visible with the naked eye. This consisted wholly of ordinary entire corpuscles. There was no corpuscular débris, nor any casts. There was a trace of albumen; a distinct blood reaction with guaiacum; none with the spectroscope. The corpuscles ceased to present themselves, and the patient remained apparently well so long as he was under observation. But for the characteristic state of the urine first seen the case might have passed for one of stone. The later bloody urine was quite such as might have belonged to this disorder. The constitutional symptoms also were equivocal and the relations to cold not apparent. But if the urine first presented had been honestly made by the patient, the nature of his disorder did not admit of doubt.

The following sketch of the symptoms of the disorder is from the graphic pen of Dr. Druitt. It may not be unfair to presume upon the identity of the writer who tells the tale so well, and the patient whose sensations have been so minutely and so skilfully observed. I shall not venture materially to abridge this valuable contribution to the autobiography of disease.[1]

Autobiographical description of the disease by the late Dr. Druitt.

'In the summer of 1866, being then fifty-one years of age, the patient (a medical practitioner) underwent great mental and bodily fatigue through the cholera epidemic. In September of that year, while snatching a hasty holiday, he foolishly went on a very wet day to explore the ruins of Corfe Castle, and was walking or driving in wet clothes for the greater part of the day. On coming home he changed his clothes, took a warm bath, and seemed no worse; but he had a very restless night, was sick when he got up early next morning to return to London, and was shivering, sick, and giddy during the whole journey. This was the beginning of the illness from which he suffers to this day. On reaching home he was obliged to go to bed on account of the feverishness and bilious vomiting, which lasted some days. On getting up, in an exceedingly weak and prostrate condition, he was suddenly seized with inflammation of a patch of veins on the inner side of the right calf, ending in obliteration of the veins. This he hardly recovered from before the end of October, when it ceased, and has never returned; but the state of health which followed was extremely unsatisfactory.

'The patient was incessantly told by his friends that he was of a singular dusky, earthy colour, and the features "drawn." Although the appetite and sleep were good, he felt languid and under a cloud. He was subject to fits of numbness of the right foot, but yet got through his ordinary work as usual. The numbness of the foot was provoked by cold, but it would also come on if the foot were immersed in water a little too hot. Singularly enough, the patient was exposed to severe cold on a railway journey in January 1867, when the train was blocked up for some hours by snow, but without suffering from the effects which cold caused afterwards.

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[1] Two cases of intermittent hæmatinuria, by Robert Druitt. *Med. Times and Gazette.* April 19. 1873.

'So things went on till May 1867, when the patient spent a few days at Cambridge, and believes himself to have been poisoned whilst hanging over the once beautiful streams at the backs of the colleges, then polluted with sewage. At any rate, he had a succession of feverish nights, followed by two regular ague fits, coming on in two consecutive days in June 1867, at 10 a.m. There was intense shivering, and blueness, and vomiting, followed by intense feverishness. No special treatment was adopted beyond a few days of bed, followed by change of air. The ague did not return, and the patient went about his work as usual, though he complained of a good deal of languor and backache.

'During the summer of 1867 the patient went to Switzerland, hoping to re-establish his health entirely. Whilst clambering about Chamouni, in the brightest weather, under a warm sun, and freely perspiring, he felt absolutely well. Unluckily he prolonged his tour, and went to Grindelwald, where, on a coldish morning, in the midst of clinging mist, he visited the glacier, and foolishly went into the grotto cut out in the solid ice. Here he got very chilly, and on his return to the hotel had a most severe attack of shivering, with blueness of the hands. This gave way to a good draught of wine, and was succeeded by no feverishness as on former occasions ; but it ushered in the prominent feature of the case as follows :—The shivering lasted till about one o'clock. Early in the afternoon the patient started to return to Berne, which was reached in the evening. The bladder was habitually capacious and free from irritability, so that no urine was voided between leaving Grindelwald and reaching Berne, when, to the patient's horror on going early to bed, he passed a very large quantity black as porter, and evidently containing a large quantity of blood-stuff. The patient was so alarmed at this that he slept ill, and rose in the middle of the night to pass more water to see what it was like. This was absolutely pale and natural-looking; the bloody admixture had passed off as suddenly as it came.

'The patient soon returned to England, and during the rest of the autumn of 1867 was excessively weak and languid, and obliged to give up a great deal of his work and to take more notice of the phenomena of his own bad health. It soon became evident that at every midday the urine displayed signs of some periodic disturbance: either a small quantity of blood, or of kidney epithelium, or of red, white, or pink colouring matter, would appear in the urine passed between 10 a.m. and 2 to 4 p.m.; whilst that passed in the evening usually, and at night always, was of its natural appearance. Great fatigue, aching in the loins, numbness of the legs, sense of brain-fatigue, and an earthy yellow complexion accompanied the state of urine.

'In February 1868, the patient went for a time to Bournemouth, where he recovered a good deal of flesh and strength; but, singular to say, the state of the urine became worse instead of better, whilst it was then that the last and most troublesome symptom was added to his malady. One day Surgeon-Major W——, who was staying at the same place, came to the door, and the patient put his head out of the drawing-room window to speak to him. He was conscious of a scarcely noticeable chill, but this soon passed off; and as the afternoon was bright and fresh, he went out about two o'clock for a drive. During the drive it was noticed that his face became curiously spotted with blue—just like patches of incipient gangrene—and tho same day the quantity of blood-stuff in the urine was greater than ever.

'He came back to town in March 1868, and got through the summer with more or less misery. In fine warm weather pretty well; but in cold and damp or easterly winds the diurnal loss of blood-colour by the urine and the morning fits of coldness of the feet tended to be greater than ever, though kept at bay by quinine, as will be shown presently.

'September 1868 was spent at Swanage in delicious sunshine, where the patient had good sleep, good appetite, abundance of air and exercise, and no return of any evil symptom except once. He felt perfectly well, and quite fit for his ordinary work; but on his way home to town he spent a night or two at friends' houses; the weather became damp and cold, and by the time he reached London he was as bad as when he left it.

'The next winter (1868-69) was passed very dismally, with a combination of symptoms, which may be summed up, once for all, to avoid repetition. The sleep and appetite were good ; the patient awoke feeling refreshed and well, but about nine or ten there came on with horrid punctuality a sense of languor and depression ; pulse down to 50–56 ; hands and feet painfully cold, wet, blue and cramped, like those of a cholera patient ; great lassitude and indisposition for work. In the middle of the day, after luncheon and wine, these symptoms passed off, but the urine secreted during these hours, and passed about 2 or 3 p.m., was excessively bloody. Under favourable conditions the bloody appearance passed off in the evening, and the urine passed at night was clear and natural. Few things could exceed the patient's misery ; the painful coldness of the feet hindered all mental work, and he would sit with his study door bolted, with his boots and stockings off, and blacking the soles in stripes by putting them against the bars of the grate, in the vain attempt to warm them.'

To abridge the rest of the narrative, the subject of it continued to suffer from the attacks of chilliness and hæmaturia, those in cold weather usually repeating themselves daily in the periodic fashion already described, while at other times they would occur unexpectedly as the result of some accidental exposure, together with which symptoms he had on one occasion an outbreak of what appeared to be quotidian ague, under which he became jaundiced, or at least acquired a yellowness of skin. After struggling to maintain his responsible post in the profession until November 1872, the patient now determined 'to seek in rest and the warmth of another climate the best chance of keeping the inveterate disease at bay,' and on the 7th of this month sailed for India. 'He suffered a little from his old malady during the cold winds which prevailed until he reached Malta, and had one very severe attack on November 22 from the intense cold of the railway journey by night from Alexandria to Suez. From that time, whilst enjoying the warmth of the Red Sea and of India, he had had only one attack of hæmatinuria up to the present date (February 20, 1873), and that was provoked by rising earlier than usual, and setting out early for a drive, with a feeling of imperfect reaction after a bath. The steady warmth of the climate evidently keeps this under control. He had a little feverishness from a chill at Christmas, but this was soon cut short by quinine.'

The writer then gives the following analysis of the symptoms, and the results of remedies:—

'*The feverish attacks.*—During the six years' illness the patient suffered altogether from seven distinct attacks, having the character of quotidian ague or remittent; shivering at 10 a.m.; rise of temperature to about 103° Fahr. in the evening; profuse perspirations at night; and fall of thermometer to about 100° in the morning. These attacks varied from two or three days to fifteen in duration; were always attended with intense drowsiness and jaundice, with profuse excretion (not retention) of bile, prodigious discharge of lithates, and great debility. When the temperature was high there was slight tendency to light-headedness at night. Be it observed that although these feverish attacks were the starting-point and culmination from time to time of the whole illness, yet the urine never contained blood-stuff during them, nor yet when there was feverishness from any other cause, as from a slight attack of influenza, nor yet when the patient was from any cause confined to bed or chose to be in bed.

'*Effects of cold.*—Except during these intercurrent feverish attacks, the temperature of the mouth and axilla was steadily 98·4°; but the whole heat-producing power of the economy and the power of resisting cold were singularly deficient. Precisely at 9.30 every morning (except in hot or very fine weather) the feet became cold and blue. This coldness was of the intense and most painful sort, such as used to be felt by travellers outside a coach in cold weather, causing acute suffering, attended with cramps, blueness, and a miserable wetness of the palms and soles, precisely like those of cholera patients. Equally distressing was the fact that in any brisk wind, even if not very cold, the moderate abstraction of heat from the skin would paralyse the capillaries; some part—it might be the end of the nose or the cheek—would become first pale and benumbed, then red, then purplish, and at last quite black. This was sometimes with, and sometimes without, a most unpleasant tingling. The patient, if walking out on a cold morning, would get the face so blue as to have it noticed by people in the street, and by persons at whose house he called. Of reaction against cold there was none. If the hands or feet were chilled, or the face—in fact, at any time after the use of cold water—the briskest friction was of no avail to bring on a healthy and comfortable glow.

Exposure of the skin in the morning would bring on a fit of coldness and numbness of one leg; but these effects were generally absent in the summer, when the thermometer was above 70°. The singular lividity of the skin of the face always disappeared quickly if the patient came into a warm atmosphere; but with that, as well as with the coldness and lividity of the hands and feet, mere friction was of no use. It was never followed by any worse effect. Some kinds of cold were more pernicious than others. Thus, the act of walking or standing on the wetted board-floor of a railway station was enough at almost any time to take away almost all sensation in the legs, and was followed by bloody urine. The patient always noticed that he was pretty well during a full moist, mild south-west wind, and usually was better when the barometer was low.'

With regard to the nervous system, the symptoms were found to be much under its influence. 'Mental worry and want of sleep were most efficient agents in bringing on discharge of blood by the urine.' This event was noted as ensuing upon attempts at literary work, the anxiety connected with writing of important letters, and cross-examination in a court of justice. The urine was never bloody at night save once, when the patient was kept awake by anxiety.

The urine was repeatedly and exhaustively examined, with results which may be epitomized. In the intervals of the diurnal paroxysms—early in the morning, that is, and in the evening—this secretion was perfectly natural. With the morning paroxysm there might be eliminated either a small quantity of highly albuminous urine, so filled with epithelial casts as to look like jelly or white of egg—this was rare; or, as the most frequent event, a prodigious quantity of red, yellow, and pink-colouring matter; or blood which presented several varieties of appearance. It commonly appeared as a chocolate sediment, either alone or mixed with kidney epithelium, or with lithates. This was without corpuscular structure, and, save that it had been more or less moulded into shape in the renal tubes, was amorphous—blood-substance, but not blood-shape. The supernatant fluid was sometimes not much darker than natural, at other times it was deeply coloured; water, in which raw meat had been soaked, was one of the comparisons which it suggested. On several occasions when the urine was alkaline it was of the brightest arterial scarlet. It is a familiar experience to find that blood in alkaline urine presents this tint, while in acid urine it becomes smoky or dark. The urine was never albuminous except during the paroxysm. Thus the urine would be albuminous at noon; not so at night. Dr. Letheby once examined the purple sediment with the spectroscope, and found it to display the absorption bands of blood.'

I am enabled by the courtesy of Dr. Druitt's son, Dr. Lionel Druitt, to give the conclusion of his father's case. Dr. Druitt suffered to the last from the after-effects of his malady, though he had no hæmoglobinuria for the last two years, the last attack having occurred in the spring of 1881, brought on, as was thought, by some family worry. The immediate cause of death, which took place on May 15, 1883, was pneumonia following an attack of influenza, which had been caught early in the month.

CHAPTER XXI.

ON EXCESS OF THE EARTHY SALTS, MORE PARTICULARLY PHOSPHATE OF LIME, IN URINE.

Various causes of the precipitation of phosphates in urine.

UNTIL recent years much confusion attended the use of the terms phosphatic urine and phosphatic diathesis; the urine was said to be phosphatic and the person to have the phosphatic diathesis whenever the urine deposited earthy salts: in other words, whenever it was alkaline, whether it had become so in the bladder by ammoniacal decomposition, or had been so secreted by the kidney from a deficiency of acid, or an excess of alkali. Urine alkaline from whatever cause necessarily deposits its earthy salts, whether they be much or little, and thus the phosphatic diathesis was found by the older writers in a large number of widely different conditions, comprising some of constitutional disturbance, and many others in which the reaction was simply due to the state of the urinary organs. Urine is very seldom—it used to be thought never—secreted ammoniacal. There are exceptional conditions of exhaustion or prostration apart from any localised disease, either of the nervous or the urinary systems, in which it will at times, and even for a long time together, present itself in an ammoniacal state in circumstances which lead to the belief that it has been so secreted (see page 896); but these may be put aside as exceptional, and the general rule asserted that its being passed in this state is merely an evidence of retention or cystitis. With such various conditions leading to alkalescence and deposition, it would seem impossible without reference to their differences to discern any common diathesis or systemic state as antecedent to the urinary condition. Prout, however, in whose time the necessary distinctions had not been made, associates these depositions, however various their origin, with depression and nervous irritability; and though it is clear that in many of the instances to which he alludes the urinary state has been brought about only by disease of the urinary organs, yet there would seem to be a partial truth in his view which has escaped some later observers.

Prout, Bence Jones, and Hassall.

Dr. Hassall attributed grave constitutional symptoms to the precipitation of the crystalline phosphate of lime; but this view also has been shown to need modification since this deposit may be caused either by the increased excretion of lime, which may be caused by the administration of lime salts, or by a diminished acidity of urine short of alkalescence.[1] Whether the lime secreted by the kidneys shall appear in crystals as the acid phosphate, shall be deposited as the amorphous or alkaline phosphate, or shall be held in solution in the urine, is so far a matter of chance that it depends only on the degree of acidity of the urine. If the urine be alkaline, the amorphous phosphate is precipitated; if it be slightly acid or nearly neutral, the crystalline phosphate appears; while, however great the amount of lime if the urine be fully acid, there is no deposit whatever, or a deposit only of oxalate. No inference, therefore, save as to the acidity of the urine, can be drawn from the shape which the earthy salts take in that secretion.

But while, therefore, we regard the shape which the earthy salts take as only of secondary importance, I think that clinical evidence, to a certain extent corroborating

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[1] Dr. Bence Jones published in the Journal of the *Chemical Society* for 1861 the results of some experiments and observations in which I had taken part having reference to the deposition in the urine of the crystalline phosphate of lime. The conclusion, which was inevitable, was that the formation of these crystals simply depends on the amount of lime in the urine and on its degree of acidity. They could be generally caused by the administration of lime or its vegetable salts until the urine became charged with lime while its acidity was lessened. Dr. Roberts independently had arrived at similar conclusions.

Prout and Hassall, shows that the absolute excretion of lime, or the amount passed be the shape what it may, has an important significance as bearing upon the constitutional state, more particularly with reference to the nervous system.

The phosphatic diathesis.

In common with what I believe is a very general impression, I have learned to recognise a certain condition of nervous irritation or exhaustion, or a habitual state of exaggerated nervous mobility, as associated with urine of which the leading characteristic is an excess of earthy salts. Such urine may be alkaline and turbid, but is usually pale and clear; its tints incline rather to lemon than orange; lithates, if deposited, are pale or white; it is but rarely of insufficient acidity, and sometimes is acid to excess, even to scalding. Excepting occasional lithates, it is usually free from deposit, or deposits only oxalate of lime. The addition of liquor potassæ or ammonia, however, throws down a heavy cloud, which consists chiefly of phosphate of lime. The persons who have passed such urine have mostly been men not far removed from middle life, usually of active minds and nervous temperaments, easily agitated or depressed, tremulous, excitable, and prone to sleeplessness. Many have had obscure arthritic pains which have been regarded as gouty, but few gout in a sthenic and declared form. The characters of the urine became more marked, and in some instances first attracted my attention, after some period of anxiety or mental distress.

Character of urine.

Subjects and symptoms.

A symptom to be often noted in such persons as I have described is a somewhat indefinite numbness in the legs which comes and goes; others have complained of singing, dizziness, or other abnormal sensations in the head. The tongue is usually anæmic, flabby, and sodden; it becomes more coated under salines or alkalies, and clear with strychnia and nitro-hydrochloric acid. There is intolerance of alkalies in these cases, for whatever cause they may be given, displayed by general prostration and early alkalinity of urine. Strychnia and the mineral acids, on the other hand, are as constantly beneficial.

Excess of earthy salts with articular and nervous symptoms.

A gentleman, who is mentioned in the annexed table as Mr. Y——, furnished a good instance of what I have referred to. He had lost his wife a year and a half before I first saw him. His symptoms were then much more severe than subsequently, though they were never entirely and for long absent. He was excitable, wakeful, nervous, and hypochondriacal. He had frequent pains and abnormal sensations in the head, and often complained, as persons with his condition of urine do, of numbness in the legs, with some uncertainty in walking, not amounting to visible unsteadiness of gait. He was tremulous and emotional. He was subject to pains in the small joints which had attained once or twice to the rank of definite, though not severe, gout.

The urine was always the same: pale, clear when passed, though often depositing white lithates; it was acid, sometimes under exceptional worry or distress very highly so; it gave a heavy cloud with liquor potassæ, suggesting an excess of earthy salts which was ascertained by more exact methods, the percentage of lime on one occasion amounting to ·07 against ·02, which is about the average of health. The urine was made alkaline by doses of medicine generally not enough to cause such a result; and with the urinary change alkalies or salines caused remarkable prostration. The tongue was often flabby, anæmic, sodden-looking, and uniformly covered with a white fur; these conditions were remarkably exaggerated by alkalising remedies; lessened or removed by mineral acid and strychnia.

Excess of earthy salts in connection with mental strain.

A member of Parliament, who is referred to in the table as Mr. X——, of similar age to Mr. Y——, with a similar nervous, anxious, and sensitive temperament, and also like him with occasional slight gouty manifestations about the finger-joints, and numbness in and above the heels, habitually passed such urine as in the preceding case. It was pale, clear, or only clouded with white lithates; under the microscope it sometimes showed crystals of oxalate of lime, and more rarely of uric acid; with liquor potassæ it gave a heavy precipitate of earthy salts, and showed, when more exactly examined, a percentage of lime, on one occasion amounting to ·06.

The urinary and general symptoms were much exaggerated for a time, while the subject of them held an office which compelled him to be almost constantly present during the sittings of the House of Commons.

He was intolerant of alkalies, which produced prompt depression and alkalinity of urine; while he derived remarkable and continued benefit from strychnia, with or without nitro-hydrochloric acid.

Excess of earthy salts with over-work.

A sallow, dark-haired, melancholic-looking gentleman, of the age of 40, who proved to be a medical practitioner, of late much harassed by midwifery and parish work, came to me, not knowing, as he said, whether he stood upon his head or his heels, having that morning discovered that his urine was albuminous.

The urine was pale, natural in appearance; it gave a heavy cloud with boiling exactly resembling albumen, but instantly dissipated by a drop of acid. Liquor potassæ gave a large precipitate characteristic of great excess of the earthy salts.

The tongue was pale, coated, flabby, and tremulous; the pulse slow and feeble. Inquiring for numbness in the legs, to the surprise of the patient, I found that he had recently discovered this symptom, much to his alarm, while feeling for œdema.

The patient was warned to abstain from alkalies, which he had been taking before; put upon strychnia and mineral acids, and sent to Folkestone. He rapidly recovered his general health, but I had no further opportunity of examining the urine.

Excess of earthy phosphates with nervous symptoms.

A country lawyer, with a debilitated look and nervous manner, 28 years of age, who had been of late much pressed by work, complained that in talking he now and then lost for an instant the thread of his discourse. He had constant singing in the left ear—recently he had had it in both. He had 'pins and needles' in his left leg, which was 'fidgety' and numb.

The urine was natural in appearance; with liquor potassæ it gave a large deposit of the earthy phosphates.

Excess of earthy salts with nervous symptoms.

A gentleman of Devon, 40 years of age, was sent to me with, as was supposed, albuminuria.

He was thin and eager, and had a nervous manner. He had, and had had more or less since the age of 20, peculiar feelings, which came up from the epigastrium to the head, and there caused what he described as a 'bouleversement'—some feeling akin to vertigo, for it prevented his riding on horseback by the fear of falling which it entailed. This was always worst about eleven in the morning, and wore off as the day went on. He had feelings of numbness in both legs; the tongue was pale, macerated-looking, and coated with white. He inherited, but had not yet displayed, gout.

The urine, often passed with frequency, was highly acid; it was clear and natural in appearance; it deposited crystals of uric acid and oxalate of lime; and with liquor potassæ gave a bulky white precipitate, such as a large amount of albumen would give with nitric acid. There was no trace of albumen.

Excess of earthy salts coincident with examinations.

A gentleman of nervous temperament, always unduly distrustful of his own abilities, had to pass the numerous examinations which beset the path to a Cambridge degree and the profession of medicine. As each examination drew near the urine commonly threw down a copious sediment of white sand, which was found to consist of crystalline phosphate of lime. This usually vanished after the examination, and reappeared on the eve of the next.

General observations.

Instances of an excess of the earthy salts, particularly of the phosphate of lime, in such circumstances as I have mentioned might be greatly multiplied. I have learned to recognise the manner of man in whom it exists, and seldom look for it in vain. The nervous, mobile, and hypochondriacal temperament, with perhaps half-latent gout, suggests the testing of the urine with liquor potassæ, and the fall of the bulky precipitate no less suggests the use of strychnia and the mineral acids. Examples, some of which have been already alluded to, which show the amount of the earths passed in twenty-four hours, or where this was not possible in 100 parts of urine, are subjoined in a tabular form. [See p. 1240.]

The only one of the tabulated cases which needs further mention is the last of the first series. It was remarkable in the habitual presence of profuse alkaline sweat which was poured out abundantly, particularly under the arms, even though the patient kept cold and perfectly still. The secretion was alkaline from fixed alkali. It increased with depression or exhaustion, and lessened with rest, good diet, and tonics. Both lime and magnesia must be considered as increased, considering the age of the patient.

Increase of earthy salts in brain diseases and diabetes.

To take a somewhat wider view of the urinary excretion of lime and magnesia, I have subjoined a few observations in reference to other disorders, from whence it appears that in instances of tubercular disease of the brain, tubercular meningitis, epilepsy, and cerebral amaurosis, the exit of lime was increased. To the foregoing facts may be added that in some cases of diabetes, especially the most acute, there is, perhaps, a larger increase of phosphate of lime than occurs in any other circumstances. The woman Mackay passed as much of this salt in one day as she should have passed in ten; more than three grammes of lime, or about six of the phosphate. This salt was increased out of proportion to the urine, and in larger ratio than any other of its constituents. (See page 123.) The condition was associated with cerebral changes of unusual extent and rapidity, as witness the woodcuts on pages 39 and 40. In another rapid and severe case (see page 113) was nearly as great an increase of the earth in question. It is noteworthy that this enormous increase of lime was not dependent on any increase of food; but, on the contrary, was most marked when the disorder was approaching its fatal termination, the power of taking food almost lost, and the urine no longer saccharine, or but slightly so. (See page 176.)

Their diminution in delirium tremens.

Observations on the excretion of phosphates in disease were made by Bence Jones as long ago as 1846.[1] The most marked result of his inquiry was the contrast in this respect between inflammatory affections of the brain and delirium tremens; in the former, meningitis and the like, both the total phosphoric acid and the earthy phosphates being much increased, in delirium tremens both being as strikingly diminished. According to the view of Bence

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[1] *Med. Chir. Trans.* for 1847.

TABLE I.[1]

Amounts of Lime and Magnesia in the Urine in various morbid conditions, especially of the Nervous System.[2]

Name	Abstract of Case	Urine in 24 hours except where stated. Grammes and Centimetres.				
		Quantity	Acidity	Lime (CaO)	Magnesia (2MgO)	Total Phosphoric Acid
	Cases of Nervous disturbance regarded as functional—irritability, over-sensitiveness, and want of sleep, mostly after mental disturbance.					
Mr. X—— . .	Nervous, anxious, and sensitive in temperament. Overworked, harassed, and deprived of sleep by arduous and protracted duties in Parliament. Occasional numbness in heel. Sometimes wandering pains in joints regarded as gouty. Tongue habitually clean. Depression much increased by small doses of alkalies; constant benefit from strychnia and the mineral acids.	—	Acid	·0626 per cent.	·0142 per cent.	—
		1490	Acid	·482	·127	2·53
Mr. Y—— . .	Between 50 and 60. Nervous, sensitive, emotional, tremulous, eager to relate symptoms, somewhat hypochondriacal. Active in mind and body, often sleepless. Symptoms much aggravated by death of his wife. Tongue flabby and sodden, thickly and uniformly coated, often tremulous. Pains in joints with occasional slight swelling regarded as gouty. Occasional numbness in legs. Intolerant of alkalies, benefited by strychnia and nitro-hydrochloric acid.	—	Intensely acid	·078 per cent.	·030 per cent.	—
Mr. D—— . .	A manufacturer, 52 years of age. After much anxiety in business and in his family, began to have attacks of giddiness, in one of which he fell from his horse. They were generally brought on immediately by worry; they were accompanied by nausea and vomiting; relieved by stimulants and lying down. Never loss of consciousness nor any paralytic symptoms. Occasional headache. Sleeplessness. Frequency of micturition especially at night. Benefit from strychnia, rest, and change.	—	Alkaline from fixed alkali	·031 per cent.	·006 per cent.	—
		950	Highly acid	·441	·123	—

Mr. E——	Aged 25. After long stress of work preparing for examination, and more particularly after having failed, fell into a nervous state succeeded by throbbing and noises in the head, singing in ears, sleeplessness, and incapacity for application. Numbness in both arms and legs, tongue white and tremulous; much mental depression. Some benefit from strychnia.	900	Intensely acid	·296	·247	—
Henry Channell, aged 14.	A thin, anæmic, and nervous youth, for three years hard work as a pupil-teacher, to which he attributes his disorder, the most marked symptom of which is profuse *alkaline* sweating, most under the arms, causing an incrustation on clothes like diabetic urine. Benefit from tonics and liberal diet. Urine often alkaline.	720	Acid	·227	·228	—

TABLE II.

Cases of Recognised Disease of the Nervous System—Meningitis, Epilepsy, etc.

— Newton	Aged $4\frac{1}{2}$ years. Epilepsy. Three attacks on previous day.	—	Acid	·02 (per cent)	·018 (per cent)	—
Julia Wigmore	Aged 18. One month after labour, series of convulsive attacks, followed by temporary coma, and a week later by gradual, at last total, amaurosis of both eyes without any paralysis. Intracranial thrombosis? Urine depositing copiously crystals of acid phosphate of lime.	1080	Naturally acid	·495	·152	1·18
		,,	—	·431	·178	Precipitated from fresh urine
John Hartigan	Aged $3\frac{1}{2}$ years. Chronic tubercular disease of the brain, with great distension of the ventricles. Ill three months.	140 (possibly a little lost)	Alkaline ammoniacal	·0057 (per cent)	·0014 (per cent)	·04 (per cent)
George Spaggett	Aged 11 years. Acute tubercular meningitis, with intense congestion of brain. Little fluid in ventricles. Convolutions flattened chiefly by congestion.	,,	—	·008	·002	·056
		—	Acid	·023 (per cent)	·019 (per cent)	—
Frances Cornwall	Aged 7 years. Chronic tubercular disease of brain, with distension of ventricles. Ill 12 months; worse for a fortnight.	225	Ammoniacal	·07	—	·36

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[1] It may be convenient to state for the sake of comparison that the normal average of lime (CaO) excreted by the kidneys in 24 hours may be taken, according to Parkes, at about ·260 grammes; that of magnesia (2MgO) at about ·203 grammes. Taken in percentage the lime would be about ·0017 in 100 grammes of urine; the magnesia about ·0013 in 100 grammes.

[2] The amounts of lime and magnesia were usually ascertained from the ash, the lime weighed as sulphate, the magnesia as pyrophosphate; methods which are believed to give accurate results.

Jones, the phosphorus which so largely enters into the composition of the brain undergoes under inflammation increased oxidation, with a correspondingly increased production and exit of phosphoric acid. The lessened discharge of this acid in delirium tremens was no doubt partially due to absence of food, but it was shown that it could not be wholly thus accounted for, and might with probability be attributed to lessened chemical action in a brain of which the condition was the opposite of the inflammatory.

About a third of the phosphoric acid which is normally passed with the urine is in combination with lime and magnesia, the rest with potash and soda. It is not my purpose to dwell upon the variations of phosphoric acid in disease, which have received full attention, but rather to refer to those of the earths which are more striking, and appear more indicative than any alterations in the urinary phosphoric acid taken as a whole.

General conclusions.

For purposes of chemical estimation, it may be assumed that the earths occur in the urine wholly as phosphates; lithate of lime is a rarity; and the oxalate, however frequent, does not attain an amount to be appreciable save with the microscope. The amount of earthy phosphates can be judged of either by ascertaining the amounts of lime and magnesia separately, the more laborious process, but as distinguishing the earths the more instructive, or by precipitating both together as phosphates. A rough but trustworthy bedside guide, if the urine be clear, is the bulk of the precipitate presented to the eye on the addition of liquor potassæ or ammonia. Perhaps it is more to the purpose to associate the earthy excess clinically with conditions of nervous irritation, than to speculate on the internal chemistry by which the discharge is produced. What lime can have to do with brain is hard to see; it enters most sparingly into its composition, and can scarcely be an appreciable product of its waste; phosphorus, on the other hand, abounds in nervous tissue, and under disintegration or change may be a copious source of phosphoric acid. And this poured into the blood, the conversion of much of it into phosphate of lime, and its exit in this shape, is what may be reckoned upon having regard to the affinities of the acid and the base. Against this view we have the leak of evidence that the phosphoric acid is increased otherwise than in earthy combination, and also the minute but at least suggestive appearance of lime in other forms than as phosphate. Whatever be the explanation of the facts which have been noted, it is clear as a matter of clinical experience that an increased discharge of earthy salts in the urine appears in connection with many forms of nervous irritation, and affords in some circumstances a ready and valuable therapeutical guide.

CHAPTER XXII.

ALBUMINURIA GENERALLY CONSIDERED IN RELATION TO RENAL AND OTHER DISORDERS.

URINE may be secreted albuminous, or may be made so, since its secretion, by admixture with some albuminous product. To dispose, in the first place, of what may be termed accidental albuminuria: this may be due to the intrusion of blood, pus, or chyle. It was formerly thought that the spermatic fluid could produce this effect, but now stated that semen is not albuminous. These vehicles of albumen are easily recognised by their obvious and microscopic characters; the only doubts which ever need present themselves are, supposing the urine to contain blood or pus, whether the albumen is wholly or only in part due to this cause.

Tests for albumen.

It is not my design to dwell at length upon the means of testing for albumen, some of which have occupied much attention of late.[1] Whenever the urine is described as albuminous in this work, it is upon the evidence of heat and nitric acid. I examined for albumen by five methods the urine of 100 patients, as they presented themselves consecutively in hospital and private practice. The results which are given in the annexed table are scarcely calculated to make us abandon the old tests for the new. The potassium mercuric iodide gave a precipitate in every instance, including many in which there was no reason to doubt that the urine was absolutely natural. Picric acid was the next frequent in result. It is known that both these reagents precipitate other matters beside albumen, more particularly the peptones. Whether urine always or almost always

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[1] See *Bedside Urine Testing*, by Dr. Oliver, of Harrogate.

Urine from 100 Cases taken consecutively from Hospital and Private Practice tested for Albumen by several methods.[1]

Cases	Number of cases	Heat and nitric acid	Picric and citric acids	Ferro-cyanide and citric	Mercuric pot. iod. and citric	Brine and hydro-chloric acid
Albuminuria from disease of kidneys	19	19	19	19	19	19
Convalescent from nephritis	1	—	—	1	1	—
Stone in kidney . . .	6	2	5	2	6	5
Disease of bladder or prostate	3	1	2	1	3	1
Diabetes mellitus . .	8	4	5	4	8	4
Diabetes insipidus . .	1	—	—	—	1	—
Excess of uric acid or urates	2	—	1	1	2	—
Excess of phosphates . .	2	—	—	—	2	—
Intermittent hæmaturia .	1	1	1	1	1	1
Organic disease of nervous system, tumour of brain, locomotor ataxy . .	3	—	1	—	3	1
Functional nervous disease, epilepsy, chorea, tinnitus	4	1	2	—	4	1
Nervous debility . . .	3	—	—	—	3	—
Valvular disease of heart and aneurism . . .	3	2	2	2	3	3
Tubercular disease of lungs, peritonæum, &c. . .	7	—	2	—	7	—
Pneumonia and broncho-pneumonia . . .	3	—	—	—	3	—
Bronchitis	1	—	—	—	1	—
Fluid in pleura . . .	1	1	1	1	1	—
Typhoid	2	1	1	1	2	1
Measles	1	1	1	1	1	1
Tonsillitis	2	—	2	1	2	1
Convalescent from acute febrile affections . .	6	—	—	—	6	—
Disease of liver . . .	5	2	2	1	5	2
Ulcer of stomach . .	1	—	—	—	1	—
Diarrhœa	1	1	1	1	1	1
Enteralgia	1	—	—	1	1	1
Peritonitis	1	1	1	1	1	1
Rheumatism, sciatica, muscular pain . . .	8	2	4	2	8	2
Eczema	1	—	—	—	1	—
Anæmia and amenorrhœa .	3	—	1	—	3	—
	100	39	54	41	100	45

contains a substance analogous to albumen, which is not true serum albumen, must be determined by further enquiry. Dr. Green has published some interesting researches, from which he concludes that healthy urine contains an albuminoid substance which he calls leth-albumen,[1] a modification of albumen not recognisable by ordinary tests. Whether this be so or not, it is certain that a slight precipitate or opalescence with the mercuric iodide is not necessarily a sign of disease, and that the test cannot be accepted as a practical guide. Probably nitric acid and heat, used so as to be mutually corrective, and the ferrocyanide with citric acid are the best tests for practical use. Picric acid and the mercuric iodide are not sufficiently discriminating.

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[1] When the urine of the same case has been examined repeatedly the first observation alone has been tabulated. No examination was made without finding a precipitate or opalescence with the potassium mercuric iodide.

Reactions of albumen and albuminoid bodies in the urine.

The reactions of albuminous urine with the precipitants of albumen, apart from the peculiarities which depend upon its occurrence in acid or alkaline urine, are liable to variations which appear to be explicable only on the supposition that there are differences in the albumen. Prout describes chylous urine as containing a substance which was coagulable by acid but not by heat, which he regarded as hydrated or incipient albumen. I suppose it would now be called paralbumen. Presuming the urine to be acid, this reaction must be exceptional even in chylous urine. A peculiar albuminoid substance was discovered by Bence Jones [2] in the urine of a patient who had mollities ossium. On the addition of nitric acid no change was at once produced; on standing, the urine became solid; with heat it resumed its liquidity.

With regard to the reaction of albumen and nitric acid, it was long ago pointed out by Bence Jones that the addition of a minute quantity of this acid to albuminous urine will often

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[1] Leth-Albumen, by John Greeve. *Brit. Med. Jour.*, May, 1879, p. 696.

[2] A substance resembling albumen, which Bence Jones regarded as a hydrated deutoxide of protein, was discovered in the urine of a patient who had mollitics ossium. This substance was discharged in large amount—twice that of the urea—the urine was acid, of very high specific gravity—1035 to 1040—frothy and glutinous. Heated to boiling it gave a precipitate like albumen; with nitric acid, however, in the cold, no immediate precipitation took place, though after a time the urine became converted into a yellow, transparent mass, which, like gelatine, was dissolved by heat and again consolidated on cooling. Though some degree of œdema was present in this case, the kidneys were found to be natural after death, so that we can but attribute the peculiar discharge to some condition of blood connected with the softening and wasting of the bones.

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[1] Case of Mollities and Fragilitas Ossium, by W. Macintyre, M.D. *Med. Chir. Trans.* for 1850. Also paper by Dr. Bence Jones in *Phil. Trans.*, for 1848.

prevent its giving a coagulum with heat, though it will still coagulate on the addition of more acid. This, he supposed, was owing to the formation of a nitrate of albumen, coagulable by acid, but not by heat. This reaction appears to present considerable variation in the proportion of acid needed, and to be not always obtainable. Next, it is to be recognised that albumen is soluble in excess of nitric acid, and that this solubility differs greatly in different specimens. An albuminous cloud produced by acid will often disappear on the addition of only a few drops too much, while a bulky coagulum produced by acid or heat will disappear with excess of acid, the amount required for this re-solution being liable to great variation. Sometimes an amount of acid equal to that of the urine will do; more often three or four times the bulk is needed.

A gentleman who recently died with albuminuria, presumably dependent on the granular kidney, habitually passed alkaline urine, which, with heat and one drop of nitric acid in an ordinary test tube, coagulated to about a fifth. Three or four drops reduced this to a mere opalescence; five or six made the urine clear. I may add that this urine, when it chanced to be acid, displayed abundance of casts, and that it gave evidence of globulin with sulphate of magnesia. Albumen precipitated by acid is generally more soluble in excess of it than that thrown down by heat. The albumen of lardaceous disease is often more soluble than that which presents itself in other forms of albuminuria, and it has been occasionally noticed that the clot produced with hæmoglobinuria is re-soluble in more than ordinary proportion, and the peculiarity in this instance attributed to admixture with globulin.

We probably have much to learn with regard to the behaviour of albumen and its allies in different circumstances. Such differences as have been adverted to, together with the occasional slowness with which nitric acid causes coagulation, have given use to the term, peculiar albumen,[1] to signify albumen which is less coagulable or more soluble than common. Some of the phases of incoagulability may be supposed to indicate an approach to the peptones.

Peculiar albumen.

Peptone.

I do not propose to dwell upon the subject of peptone in urine, of which both the chemical and clinical relations are as yet imperfectly understood. Peptone is not precipitated by heat or nitric acid, and so does not complicate the subject of albuminuria if only these tests be used; but it is thrown down by picric and citric acid, and also by the potassium mercuric iodide together with citric acid. The formation of a precipitate with these reagents, particularly with the mercuric test when the older means of discovering albumen give no result, is so common, that the presence of something which acts like peptone in this respect must be the rule rather than the exception. But it is probably not peptone, but rather something else allied to albumen not yet identified, for it is often present in considerable quantity when the copper test gives no result. Peptonuria, as recognised chiefly by the latter test, appears to be comparatively infrequent, and to have scarcely as yet acquired practical interest. It has been found in a variety of disorders not especially renal or attended with albuminuria, among which phosphorus poisoning, suppurative conditions, and gastric and intestinal disturbances have been mentioned.

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[1] See Dr. Haddon on Peculiar Albumen. *Brit. Med Jour.*, 1876, Part i., pp. 191, 256, 286, and 381.

Globulin.

The presence of globulin, or rather paraglobulin, in urine has more to do with albuminuria than has that of peptone. The occurrence of this substance together with the other constituents of blood in hæmoglobinuria has no separate interest. The amount of it may be easily estimated by precipitation with sulphate of magnesia.[1] It would seem that paraglobulin is almost never present in urine except it be also albuminous, and that when it is so, unless it be also bloody, this addition is found only exceptionally or only in very minute amount. Paraglobulin is not soluble in pure water, though it is so in weak saline solutions. Dr. Roberts has recently pointed out that a drop of albuminous urine allowed to fall into a glass of distilled or even ordinary drinking water, a delicate ring of opacity, like a puff of smoke, will often accompany its descent. This he attributes to the paraglobulin separated from the albumen by its insolubility. This reaction is often to be found when globulin is not to be detected with sulphate of magnesia, and it must still remain *sub judice* upon what it depends.

This constituent of the blood appears to have been found in urine more frequently with the acute and the lardaceous forms of renal disease than with others. A fatal instance of acute nephritis with dropsy has been described, in which the urine contained globulin, to the entire exclusion of serum albumen. Casts were present as in ordinary cases.[1]

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[1] Dr. Marcet reminds me of the reactions of globulin as obtained from the crystalline lens. It is precipitated by carbonic acid; soluble in ammonia; precipitated from the ammoniacal solution when this is neutralised with acetic acid; re-dissolved in excess of acetic acid.

General significance of albuminuria.

Speaking of albumen as something which is to be detected with heat and nitric acid, it may be said that urine which is secreted albuminous is to that extent abnormal. The arrangement is faulty either in the renal mechanism, or in the composition of the blood, or in the pressure to which it is subjected. Whether a minute trace of albumen, such as to be inappreciable to most tests, may consist with health, or whether healthy urine contains traces of an albuminoid substance, possibly occupying a position between albumen and urea, are questions which must be postponed; but, at any rate, it is certain that any such considerable admixture of albumen as to be readily detected with heat and nitric acid is evidence of disease, whether permanent or temporary.

Permanent and temporary.

Albuminuria has been divided into permanent and temporary, and many observations have been made to show in what proportion of persons one sort or the other exists, and with what disorders they are associated. Thus, of 303 adults in the medical wards of University College Hospital, 39 had, according to Dr. Parkes, permanent, and 37 temporary, albuminuria, while in the remaining 227 cases no albumen was present at any time. Thus, the proportion of albuminuria, passing or lasting, was almost exactly one in four.[2]

Frequency of albuminuria.

Dr. Saundby examined the urine of 145 male out-patients at the General Hospital, Birmingham, and found albumen in 105.[3] In 64 the albumen was attributed to renal disease. Deducting these, there remain 81 cases of non-renal disease—dyspepsia, debility, phthisis, morbus cordis, etc., among which the urine was albuminous in 41, or about half. I have already stated the proportion of albuminuria in patients taken indiscriminately from hospital and private practice as deduced by different tests (p. 1245). Of the 100 cases referred to, 19 were of kidney disease, necessarily attended with albuminuria; of the remaining 81, the urine showed albumen to heat, and nitric acid in 21, about one case in four. It is seen with sufficient clearness in the table how much the results differ with different reagents. Dr. Mahomed found albumen to be present in the urine of persons proposed for life assurance in a proportion of 15·5 per cent. Dr. Mann[1] in the same circumstances found albumen in 11 per cent. With our present knowledge we must believe that, however slight or transient a disturbance may make the urine albuminous, this condition, as it is ordinarily recognised, is not consistent with absolute health.

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[1] *Lancet*, 1883, vol. ii. p. 1001. Dr. Womer, of Heidelburg.

[2] *Parkes on the Urine*, p. 187.

[3] Dr. Saundby, on the Diagnostic Value of Albuminuria. *Brit. Med. Jour.*, 1879, vol. i. p. 699.

Its causes.

The causes of albuminuria afford a more convenient basis of classification than its persistence. Urine which, independently of admixture, is persistently albuminous indicates a persistent change in the kidney, whether arising in it or secondary to disease elsewhere; but, on the other hand, it is possible that, though such disease exist, the urine may be albuminous only at times. Thus no safe distinction can be made between permanent and temporary albuminuria.

To bring within a simple classification the various circumstances upon which an albuminous state of the urine may depend, they may be arranged into three great classes: the first may be termed accidental albuminuria, or albuminuria by admixture, in which the secretion has been rendered albuminous subsequently to its secretion; the second comprises the many modes in which the urine may be made albuminous by renal disturbance, whether connected with structural change or circulatory embarrassment; the third includes those rare instances in which the kidneys secrete albumen in consequence of an altered condition of the blood itself. In the accompanying table all the subdivisions except the first and last presumably belong to the second class.

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[1] Quoted by Dr. Middleton. *Discussion on Albuminuria.* Glasgow, p. 122.

Causes of an Albuminous State of the Urine.

Admixture with blood, lymph, chyle, pus, or the contents of cysts opening into the urinary channels, or with products derived from the bladder or tissues after death.

Independently of such admixtures, urine may be albuminous from :—

Structural diseases of the kidney	Nephritis, tubal or diffuse. Granular degeneration of kidney, or interstitial nephritis. Lardaceous disease of kidney. Abscesses in kidney, pyæmic or uriseptic. Embolism. Thrombosis. Tubercular disease of kidney. Cancer or other growths in kidney. Cystic disease of kidney. Dilatation of kidney from present or past obstruction.
Congestion of kidney from mechanical causes	Pregnancy, with consequent renal congestion. Disease of heart " " " Obstruction to renal circulation by other mechanical causes, tumours, &c., pressing on emulgent veins or vena cava. Dyspnœa from croup, laryngitis, bronchitis, &c. Respiratory embarrassment of epilepsy.
Other causes, acting presumably by way of renal congestion	Exposure of surface to cold, as in bathing. Ague fit. Venous congestion of the dying ? Generally increased vascular tension from state of blood ? Masturbation.
Extraneous irritants	Cantharides, arsenic, phosphorus, lead, silver, mercury (?), &c.
Inherent irritants	Bile in cases of jaundice, sugar with diabetes. With stone the urine may be slightly or temporarily albuminous, though there be no disease of the kidney itself.
Specific fevers	Scarlatina, diphtheria, typhus, typhoid, erysipelas, small-pox, measles, &c.
Pneumonia.	
Cholera and diarrhœa.	
Nervous changes	Certain nervous conditions—injury of brain and state connected with exophthalmic goitre—presumably affecting renal blood-vessels.

Changes of blood irrespective of renal disturbance	Large ingestion of albumen. Dyspepsia? ? ? Destruction of blood corpuscles, as in intermittent hæmaturia. Purpura. Scurvy. Various septic and febrile conditions. A state of blood connected with certain conditions of the liver?

Albuminuria of renal disease; significance of casts.

Albuminuria, so far as it relates to renal changes, has been fully discussed. Casts often throw light upon the source of albumen. If these contain blood, or, as with intermittent hæmaturia, its substance, it is obvious that the glandular structure gives exit to the discharge, though it may remain to be determined whether local congestion or humoral change is the cause. If epithelial, they indicate tubal disturbances and an organic reason, though possibly only of a transient kind, for the albuminous discharge; if merely fibrinous, they show at least that not albumen only, as if that substance were in excess, but the liquor sanguinis in toto is making its way out by reason probably of local hyperæmia or structural change. But while casts as a rule show that the issue of the albumen depends upon some change in the structure of the kidney or in the tension of its vessels, it is not to be concluded from their occasional absence that it is not so. In the early stages of the granular kidney casts are often as infrequent as in the early stages of nephritis they are abundant. The evidence afforded by the presence of casts is therefore more to be relied upon than any inferences to be drawn from their absence. With embolism and renal pyæmia casts are usually to be found, often with blood; with tubercular disease of the kidney, though casts are not necessarily present, yet they are often to be found in consequence of some localised tubal disturbance in the affected organ or secondary lardaceous change in the other. With renal stone a few casts are occasionally found, probably from localised irritation, though it may be practically certain that there is no general disease of the kidney substance.

As to whether albumen be the result of mechanical congestion as from heart disease or of some disorder particular to the kidney, the distinction may often be made at a glance; with cardiac congestion the urine is apt to be scanty and loaded with lithates; with disorders primarily renal, the urine however scanty is only exceptionally lithatic.

Varieties of renal disease as causes of albuminuria.

In distinguishing the structural diseases of the kidney from each other, the albumen is often a guide in its mode of accession; with nephritis it becomes early large, to decline gradually with the disease; with the granulating kidney it is at first, and often for long, slight, or intermittent, in the later stages sometimes little and sometimes much; with the lardaceous it is early in minute quantity, latterly abundant.

There are few structural diseases of the kidney which are not apt to make the urine albuminous, though they may not do so of necessity. Albumen appears with renal embolism, and also when the renal veins are obstructed by thrombotic clots. Tubercular disease often appears, probably from tubal disturbance in the neighbourhood of the formation, to cause more albumen than the pus can account for, and it has even been stated that at the outset of the disease the urine may contain albumen and rarely epithelial cells. Cancers and other growths do not necessarily make the urine albuminous; it may happen, indeed, that this secretion is absolutely natural, notwithstanding the extension in the kidney of large growths, so long as these be not exposed in the pelvis; but traces of albumen are apt to present themselves apparently from irritation of the gland by pressure or contiguity.

The urine may be albuminous from cystic disease as with the granular kidney; and it commonly shows at least a trace of albumen, the urine being pale and of low specific gravity, if the kidneys have been much impaired by dilatation.

The urine, usually pale and copious, which is passed after obstructive suppression, is sometimes slightly albuminous, whether, as has been suggested, from compression of the renal veins, or, as perhaps is more probable, from distension of the tubes, and irritation of the gland by its own secretion.

Next to structural disorders it is sufficiently clear that mere increase of pressure within the renal vessels, particularly when this is connected with venous obstruction, may cause the transudation of serum. Dr. Robinson long ago made the urine albuminous by compressing the renal vein, and we see a similar process in operation, as has been enough dwelt upon, when the abdominal veins are compressed by the gravid uterus or the whole venous system made turgid by cardiac obstruction. Though structural changes may be produced by these causes, yet from the frequently fugitive nature of the albuminuria so engendered, it is certain that the transudation may take place quite independently of renal disease. Of the same nature is the albuminuria of dyspnœa; it is very general to find at least a trace of albumen in croup, even though this be catarrhal, not diphtheritic; and the urine has been found to be temporarily albuminous after severe epileptic convulsion, no doubt from the respiratory embarrassment pertaining to it. To these causes of increased blood pressure within the kidney must be added the influence of the cold stage of ague with the internal congestion which it involves, and also the external action of cold in bathing. All these are causes of albuminuria, though the kidneys be undisturbed, save temporarily in their circulation. We may have to add another. Increased arterial tension is a marked accompaniment of certain diseased states with which the kidneys are apt to be granular and the urine albuminous. Does this increased arterial tension ever cause the urine to be albuminous irrespectively of renal change? This question must wait for its answer; my own observation so far points to the negative.

Many of the causes of albuminuria here referred to have been considered in the preceding pages and need no further notice; with regard to some which relate less particularly to the kidneys a few words are required.

Toxic albuminuria.

The transient albuminuria produced by the various drugs which act as renal irritants has been considered in connection with tubal nephritis; as also has the sometimes more lasting condition which results from the renal exit of bile and sugar, and from the influence of the several exanthemata, which presumably act similarly by discharging through the kidneys a special morbid irritant.

With skin disease.

Reference will also be found in connection with nephritis to the form of albuminuria which has been known to ensue upon extensive injury to the skin by disease, or in animals by the experimental arrest of its function by impervious coverings (see p. 320). There is, however, another mode in which cutaneous disease may render the urine albuminous; I have recently seen a case of extensive and fatal eczema in which the kidneys had become lardaceous, possibly in consequence of the protracted and exhausting discharge.

Pneumonia as a cause of albuminuria.

Pneumonia as a cause of albuminuria requires mention which has not yet been accorded to it.

This disease, though not to be recognised as a cause of enduring renal disease, is perhaps as frequent a cause of albuminuria as diphtheria or scarlatina. This complication of pneumonia has been much studied, and its phenomena fairly exposed to view. The frequency of albuminuria in this relation has been variously estimated. Parkes found it in 6 of 13 cases, and quotes Finger, who found it in 15 of 33 cases, and Becquerel, who found it in 9 of 21, giving a total of 30 instances of albuminuria among 67 of pneumonia, or a proportion of nearly 45 per cent. Dr. Wilson Fox found the urine to be albuminous 10 times in 32 cases, and Griesinger 63 times in 121 cases. On the other hand, Metzgar failed to find albumen once in 48 cases; while Martin Solon and Ziemssen each found albumen only twice in 24 cases. My own experience, so far as it relates to true lobar pneumonia, more nearly corresponds with the figures of greater frequency; though with pleurisy and bronchitis the urinary complication is comparatively rare.

Dr. Isambard Owen, when Medical Registrar at St. George's Hospital, kindly drew up for me the following table, the accuracy of which may be relied upon. From this statement it appears that of 26 cases of pneumonia treated in St. George's, the urine presented more or less albumen in all but four; and of those four the opportunities for observation were not always so frequent as to allow of the inferences that the urine was free from albumen throughout the whole course of the disease. It will be observed that the albumen appeared at all times between the second day and the tenth, and that no fixed relation held between its date of appearance and that of resolution.

Table Showing the Period of Albuminuria in Twenty-six Cases of Pneumonia.

The following table includes all the cases of acute pneumonia admitted into St. George's Hospital, from January to August, 1877, with nine exceptions. Of these, one was complicated with acute rheumatism, four were rapidly fatal, and in the remaining four other causes prevented the collection of the urine.

The morning secretion was, as a rule, examined whenever obtainable until convalescence was approached. The fourth column of the table contains the result of each examination made, whether positive or negative.

Sex and age	Day of disease on admission	Period of Resolution	Albuminuria
M., 40.	6th.	Temperature declined from admission; normal by 11th day, on which resolution commenced.	Urine albuminous on 7th and 8th days; a trace of albumen present on 10th; a faint trace on 11th; none on 12th.
M., 44.	7th.	Crisis on night of 8th.	Urine albuminous on 10th; no albumen present on 8th, 11th, 12th, or various subsequent occasions.
M., 23.	1st.	Resolution from 3rd day.	No albumen on any day from 1st to 5th.
M., 26.	3rd.	Resolution commenced on 5th day.	A trace of albumen on 4th and 5th days; none on 6th, 7th, 9th, 10th, or 11th.
M., 40.	8th.	Crisis on night of 10th.	Urine slightly albuminous on 9th day; albuminous on 10th; a trace of albumen present on 11th; none on 13th.
M., 25.	1st.	Resolution commenced on 4th day.	Urine albuminous on 2nd day: a trace present on 4th.
M., 56.	14th.	In full resolution on admission.	No albumen on admission.

Sex and age	Day of disease on admission.	Period of Resolution	Albuminuria
M., 29.	5th.	Temperature declined from 6th morning; normal by 9th. Resolution commenced on 7th day.	Urine slightly albuminous on 5th, 6th, and 7th days; suppressed on 8th; free from albumen on 10th, 11th, and 12th.
M., 20.	8th.	In full resolution on admission.	No albumen on admission.
M., 27.	8th.	In full resolution on admission.	Urine albuminous on 9th day; free from albumen on 18th; collection irregular owing to delirium tremens.
F., 26.	3rd.	Resolution commenced on 6th day.	A trace of albumen present on 5th, 6th, 7th, 8th, and 11th days, and on discharge; none on 9th.
F., 18.	5th.	Resolution commenced on 12th day.	Urine slightly albuminous on 9th day; a trace of albumen present on 11th, 15th, and 19th; none on 13th or 16th.
F., 32.	5th.	Crisis on night of 5th.	Urine slightly albuminous on 6th day; a faint trace of albumen present on 10th.
M., 17.	2nd.	Crisis on night of 6th.	Urine albuminous on 3rd, 6th, and 7th days; less so on 8th; free from albumen on 9th and 11th (sodic salicylate was given from the 3rd to the 6th).
M., 30.	13th.	Crisis on night of 15th; resolution commencing during the day.	Urine slightly albuminous on 14th and 15th days; a trace of albumen present on 16th; none on 17th and 18th.
F., 70.	11th.	Resolution commenced about 12th day.	Urine slightly albuminous on 11th, 13th, and 14th days.
F., 26.	4th.	In resolution on admission.	A trace of albumen on 7th.
M., 13.	5th.	Resolution commenced on 7th day.	Urine highly albuminous on 5th, 6th, and 7th days; slightly so on 8th; free from albumen on 9th and 10th.
F., 5.	11th.	Resolution commenced on 12th day.	No albumen on 12th or 17th.
M., 24.	2nd.	Resolution commenced on 5th day.	A trace of albumen present on 4th; none on 5th or 12th.
M., 27.	5th.	No resolution; death on 10th day.	Urine loaded with albumen on 8th day.
M., 39	5th.	Crisis on night of 7th.	Urine slightly albuminous on 6th day; a trace of albumen present on 7th; a very faint trace on 8th; none on 10th.
M., 4.	5th.	Resolution commenced on 8th day.	Urine highly albuminous on 5th and 6th days; slightly so on 9th, and on discharge (the face was puffy, and was said to have been so for three weeks before the onset of the pneumonia).
M., 35.	2nd.	Resolution commenced on 7th day.	Much hæmaturia on 2nd, 3rd, and 4th days; less on 5th; little on 6th; a trace of albumen present on 9th; a faint trace on 11th; none on discharge.
M., 54.	4th.	Resolution commenced on 5th day.	A trace of albumen present on 4th day; none on 7th or 9th.
F., 22.	5th.	Resolution commenced on 8th day.	Urine albuminous on 6th day; free from albumen on 11th and 12th.

The albumen is often enough to form a bulky coagulum, and it is not uncommon for the urine to contain blood, though not enough to account for the albumen. Epithelial casts are generally to be found. The characters of the urine are such as belong to tubal nephritis, save that, contrary to what occurs in nephritis as an independent disease, the urinary solids, with the exception of the chlorides, appear to be increased. Œdema is practically unknown as a result of pneumonic albuminuria, though Professor Bartels mentions in Ziemssen's Dictionary an exceptional instance, in which general dropsy with the ordinary symptoms of acute nephritis arose in the course of a genuine pneumonia. This patient recovered, and I am not aware that persistent renal disease has ever been traced to this beginning. The albumen either disappears with the acute symptoms, or withdraws more slowly during convalescence. There is some variation in the time at which this urinary change presents itself, but it does so in most cases at, or rather before, the height of the disease, while the hepatisation is on the increase, and the febrile disturbance great. The advent of the albumen appears usually to anticipate the process of resolution, so that with our present knowledge we can hardly adopt the theory which has been advanced that the renal disturbance is due to the irritating effect of the pneumonic products escaping by the kidneys. Nor can we with more probability refer to the dyspnœa as connected with the change of secretion; difficulty of breathing when extreme, as from laryngeal disease, may cause the urine to become slightly albuminous, but with pneumonia the dyspnœa is comparatively slight, and the albuminous addition considerable.

The hypothesis which of late has gained most acceptance is that the kidneys are primarily implicated in a general congestion and exudation, of which the lungs afford but the most marked localisation; it would seem, however, that the kidneys are usually affected after the lung, and less severely, while the manner of their disturbance is much that which succeeds, obviously as a consequent affection, upon many other febrile states. If on such grounds we discard the view that the renal affection is, so to speak, pneumonia of the kidney, we may take refuge in a supposition which seems indeed to spring naturally from the facts of the case. The urine becomes albuminous, and the evidences of tubal nephritis arise at the period in the disease when the essential urinary excreta are in extravagant excess, and the urinary water deficient. The increase relates to the urea, the uric acid, and the sulphuric acid; the urea in particular may be increased beyond the wont of any other disease, excepting, perhaps, diabetes, where the ureal discharge occurs together with a great flow of urinary water. Parkes found between 80 and 90 grammes of urea (between twice and thrice the normal amount) to be secreted daily from the sixth to the tenth days of pneumonia; and other observers bear similar testimony, both as to the enormous amount of urea secreted, and as to the fact that the increase is greater before than during resolution—connected, that is, with the febrile state, rather than with the absorption and discharge of inflammatory products. It is not improbable that the kidneys owe their disturbance to the functional demand thus made upon them, the attendant irritation enhanced possibly by the want of water. Observations are, however, wanted as to the exact relation of the albumen and the other nitrogenous components of pneumonic urine.[1] Cases have been reported in which, under this disorder, the urea has been less than in health; in them albumen has been either absent or in trifling quantity.

That cases of pneumonia in which albuminuria occurs are more fatal than others does not admit of doubt. Probably this complication is the more apt to occur in the more severe cases, while choking of the kidney can but add to the risk of a disorder which, like pneumonia, is productive of refuse which belongs to this exit.

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[1] Observations upon the elimination of urea, by S. West. *Med. Chir. Trans.*, 1874.

The albuminuria of cholera.

With regard to cholera also, a few words have to be added to what has found place under the heading of nephritis.

During the cold stage of cholera, the urine becomes nearly or quite suppressed, and that which is next secreted is albuminous and contains epithelial casts. The kidney itself displays much tubal obstruction and often early fatty change in the epithelium, while by some observers small vascular blockings have been described. Putting aside the latter complication, the condition, clinically and pathologically, is one of tubal nephritis, and has been considered in its place as such. But there are some further points of interest with regard to the way in which this condition is produced. It has been repeatedly asserted that the urine becomes albuminous only in cholera which is truly Asiatic, the presence of albumen being regarded as a pathognomonic symptom in this respect; but albuminuria with English cholera is by no means uncommon; and we have the evidence of Dr. G. Johnson[1] that, in a large proportion of cases of ordinary summer diarrhœa, the urine first secreted after the severity of the attack has passed contains for a few hours albumen and tube casts. Dr. Johnson infers the existence in all cases of a morbid poison by which the kidneys as well as the bowels are irritated; but the experiments of Herrmann,[2] of Overbeck,[3] and of Cohnheim[4] enable us to regard the matter in a new light, by showing the changes which the renal function undergoes in consequence of the arrest and re-establishment of the circulation. By these experiments it was shown, in the first place, what is sufficiently obvious, that the renal secretion is suspended when the current in the renal vessels is stopped, whether by compressing the renal artery or the artery and vein together or the aorta. The removal of the ligature and the readmission of blood then causes in the dog results which are precisely analogous to those ensuing upon cholera in the human subject. A condition of nephritis comes on, which lasts longer or shorter according to the length of time for which the ligature has been applied. The kidney becomes at once swollen and congested and the urine bloody; the renal vessels are found to be dilated and liquor sanguinis and corpuscles to have been effused. A similar condition of hyperæmia was produced in other structures—in the ear, for example—by a similar process, so that it could be demonstrated as a law which applied to more than one structure, that re-establishment of the circulation after its arrest is attended with congestive or inflammatory change. As the failure of circulation in the collapse of cholera is general, it may be asked why the subsequent inflammation should be most marked in the kidney; possibly the arrest of circulation may be more complete in this organ than elsewhere, in consequence of the removal of the water, which is especially necessary to the renal function, and presumably to its circulation. The double system of renal capillaries must be little suited to the transmission of the viscid blood of cholera.

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[1] *London Med. Record*, vol. i., p. 474.

[2] *Year Book of Medicine and Surgery*, 1862, p. 26.

[3] *Ibid.* 1863, p. 23.

[4] *Ziemssen's Dictionary*, vol. xv, p. 223.

Pyrexia.

Pyrexia has often been referred to, as if this condition, irrespective of its origin, were a cause of albuminuria. It is undoubted that this occurs in many pyrexial states, but it is open to question whether the complication is due to the pyrexia, or to what has caused the pyrexia. Dr. Chaffey, the Registrar at the Hospital for sick children, kindly made at my request at that institution some observations which are consistent with the supposition that the albuminuria is not due to the temperature *per se*. A comparison of the cases of diphtheria and pneumonia with those of high temperature connected with tubercle and local disease shows how much more frequent is albuminuria in the zymotic conditions, if we may include pneumonia under this head, than where no contamination of blood is suspected. It would indeed appear that the urine is albuminous, not as the result of fever, but as the result of febrile poison, or, in the case of pneumonia and cholera, of special influences which have been discussed.

Initials of patient	Complaint	Temperature	Albumen in urine
H.M., Feb. 14, 6 P.M.	Diphtheria, before tracheotomy	99·8	none
,, ,, 15, 6 A.M.	,, after ,,	101·6	trace
,, ,, 18, 6 A.M.		99·2	,,
,, ,, 21, 6 A.M.		99·2	more
,, ,, 24, 6 A.M.		98·4	faint trace
,, ,, 29, 6 A.M.		99·0	trace
F. R.	Gangrenous pharyngitis, diphtheritic	103·4	,,
K. B.	Measles	102·0	none
J. C., March 27	Typhoid	103·8	,,
,, ,, 30	,,	102·8	,,
H. F.	Erysipelas	102·8	trace
J.	Pneumonia, lobar or croupous	103·8	,,
A. C.	,,	104·0	,,
F. J.	,,	103·0	,,
E. B.	,,	102·8	faint trace
H. D.	,,	102·6	little
E. Trott	,, of apex	104·8	none
E. Taylor	,, ,,	104·6	,,
E. R.	Pleuropneumonia	104·0	trace
E. P.	Broncho-pneumonia	101·0	,,
B.	Bronchitis	102·0	none
F. B.	,,	103·2	,,
J. D.	Empyema	101·8	,,
J. G.	,,	101·0	,,
A. S., March 17	General tuberculosis	104·0	,,
,, ,, 21	,,	103·6	trace
X.	,,	103·4	none
E. R.	,,	102·0	,,
D. L.	,,	102·0	trace
G. B.	,,	103·0	none
L. H.	Phthisis	102·0	,,
G. B.	Mesenteric disease	102·8	,,
J. B.	,,	102·0	,,
E. B.	Tubercular peritonitis	102·2	,,
C.	,,	102·8	,,
A. H.	Chronic peritonitis	103·0	,,
A. S.	Meningitis	102·0	,,
E.	Psoas abscess	103·0	,,
A. F.	Morbus coxæ	103·0	,,
A. F.	,,	103·4	,,
R. N.	Abscess	101·8	,,
G. P.	,,	101·0	,,
F. C.	Acute periostitis	103·4	,,
F. K.	Abdominal tumours	101·4	,,

The temperatures were in most cases taken in the evening. The urine examined was in each case passed at the same time, or as soon as possible afterwards. The tests used were heat and nitric acid.

Nervous albuminuria

Claude Bernard long ago ascertained that while puncture of the floor of the fourth ventricle in the centre of the space between the origins of the auditory and pneumogastric nerves caused the urine to become saccharine, a puncture[1] a little higher up often made it superabundant and albuminous. A prick[2] just behind the cerebellar peduncle in a rabbit caused the urine to become both albuminous and saccharine. Further than this the same experimenter found the secretion to be rendered albuminous by injury to the sympathetic in the neck; and to approach the kidney itself, he ascertained that when all the nerves accompanying the renal blood vessels had been crushed by the temporary pressure of a ligature, the kidney was subjected to a rapid process of destructive inflammation. Other observers have supplied further details. Von Wittick showed that the urine became albuminous after section of the nerves, vaso-motor in function, which surround the renal artery, but not when only those between the artery and vein, secretory in his view, were divided. The relation of the nervous system to renal secretion needs to be further inquired into, but it is at least evident that arrest of the vaso-motor influence causes albuminuria probably by way of vascular paralysis and organic congestion. Whether the same change of secretion can be produced by any other form of nervous action has yet to be proved.

In the human subject the influence of the nervous system upon the quantity of the urine, and upon the amount of earthy phosphates which it contains, is indeed of daily experience. The watery urine of hysteria and the characters of nervous urine in either sex are well known. Suppression of urine has in some instances ensued upon concussion (p. 1310), and an albuminous condition of the secretion has been known to follow the same accident. Fischer describes transient albuminuria as a common result of concussion; such cases, however, come but little under the notice of the physician, and have, in this

from concussion of brain;

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[1] See Part I., p. 181.

[2] *Système Nerveux*, t. i., p. 460.

country at least, been insufficiently studied in this respect. As a cause of persistent renal disease, injury to the brain is scarcely recognisable.

I may refer as an exceptional instance to the case of a Canadian[1] who died with albuminuria, dropsy, and the common symptoms of renal inflammation and the enlarged white kidney—which condition, indeed, was found on post-mortem examination—eighty-six days after a fall upon the ice, in which the back of the trunk and of the head was heavily struck. The fall was immediately followed by unconsciousness, which soon passed off, and by headache and vomiting, which for a week or two were of frequent recurrence. The face became bloated and the urine scanty within four days of the accident, and within a week was found to be highly albuminous. The circumstances of this case render it probable, though by no means certain, that the renal disorder resulted from the fall: direct injury to the kidneys appears to be a less likely mode than their implication through the nervous system.

from mental causes;

Beyond such rare and possibly somewhat doubtful instances of traumatic albuminuria, we have other instances in which this condition has apparently taken origin in morbid conditions of the nervous system. I have elsewhere referred to mental disturbance as a cause of the granular kidney, an association which has been much insisted on by Dr. Clifford Allbutt. The occurrence of albuminous urine as a result of mental strain has been referred to by Sir Andrew Clark,[2] who asserts as the result of personal observation that of the young men who compete for the Indian Civil Service Examinations above a tenth become albuminuric. This statement may be taken as illustrating the albuminuria of adolescence shortly to be discussed. Another nervous source for the same change of secretion has to be referred to in exophthalmic goitre. This was carefully observed by the late Dr. Warburton Begbie, who showed that in

with exophthalmic goitre.

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[1] Reported by Dr. Curtis, of Albany. Quoted in the *Med. Record*, vol. i. p. 474.

[2] *Clinical Trans.*, vol. xvi., p. 62.

many instances of this disease the urine was markedly albuminous after food, though quite free before.[1] The vaso-motor paralysis which affects the thyroid is probably so far extended to the kidney that the blood vessels yield to the slight extra pressure which each meal occasions.

Vaso-motor failure, whether as part of a special disease or of general nervous depression or of injury to the intracranial part of the system, appears to be the essence of nervous albuminuria; it is easy to supply the steps of the process in vascular dilatation and congestive or inflammatory renal change.

The albuminuria of adolescents.

Attention has been drawn recently to a form of albuminuria which affects young persons,[2] mostly males, in their teens, or, to give a wider range, from about the age of ten or eleven to two or three-and-twenty, which has been called that of adolescents, and described as intermittent or transitory, and as unconnected with organic disease; though there is evidence that this had not entirely escaped earlier recognition. Sir W. Gull appears to have been long familiar with it; the leading features were brought into prominence by Dr. Moxon in the paper to which I have referred, and the subject has now engaged attention long enough to be spoken of in the light of experience. Scarlatina in childhood often proceeds to the granular kidney in early adult life, the event being indicated during many years of the interval by little else than slight or intermitting albuminuria. But apart from adolescent albuminuria thus connected with fibrosis, as yet latent or nearly so, there are other kinds in which no persistent change can be suspected. The cases Dr. Moxon has especially called attention to—many of which sort have, since his paper has made me watchful for them, come under my own notice—occur in this wise. A pallid, depressed, and perhaps shy or sullen youth is found to be out of health; he may have headache and inability to study. He has no dropsy or cardio-vascular change or increased arterial tension. There is sometimes a little pain in the lumbar region, more often none, or only some sensation along the lower part of the spine. The urine, which is natural in appearance, save that it is usually pale, has a natural specific gravity, and is in normal quantity, but is found to contain albumen, which varies much at different times—a good deal after breakfast, little or none before—and I may add that in some cases the albumen is more than usually soluble in excess of nitric acid. It contains no blood, nor ever has it done so. The microscope shows a large deposit of oxalate, but usually no casts.

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[1] *Edin. Med. Jour.*, April, 1874, p. 880.

[2] Dr. Moxon, on Chronic Intermittent Albuminuria. *Guy's Hospital Reports* for 1878. Dr. Clement Dukes, on the Albuminuria of Adolescents. *Brit. Med. Jour.*, November, 1878.

Dr. Moxon, who has kindly communicated to me the results of his later experience (May, 1884), tells me that in one such case, where the albumen was often present at all hours, and unusually enduring, but ultimately entirely disappeared, casts were found, but this is certainly exceptional. Dr. Moxon has constantly convicted these patients of masturbation, and I have been similarly successful in this respect, so much so that I think there can be no doubt that most of the cases in question have this origin; but nevertheless cases occur in which this suspicion does not present itself, and in which some other cause of disturbed health is apparent. The albumen, after a longer or shorter time, ceases to reappear, its presence being unaccompanied throughout by any more precise evidence of renal disease than the anæmia which has been adverted to. We have no guide as to the state of the kidney save that its condition is not one of nephritis. It may be that it becomes congested in concurrence with neighbouring organs, a possibility which finds support in the occasional though infrequent appearance of casts.

Case of adolescent albumi-

A member of the medical profession, who had obtained distinction as a student, who had been nearly a total abstainer, and unconnected with masturbation.

who assured me, I have no doubt with perfect truth, that he had never practised the habit which has been referred to in connection with temporary albuminuria, found, while house-surgeon, that his urine contained albumen. For the preceding year he had been pallid, irritable and depressed, but had had no dropsy nor any especially renal symptoms, unless some peculiar attacks of monocular blindness were to be so considered. He used suddenly to find that one eye became first dim, then absolutely dark, and this frequently occurred, the time from the first symptoms to the last being three minutes. There was no pain, giddiness, or mental disturbance with the attack; if one came on as he was helping at an operation he was able to continue to do so, nor was there any vomiting, headache, or other disturbance afterwards. In the interval the sight was perfectly good: he never had half vision, and but once or twice a suspicion of double vision. The eyes were repeatedly examined with the ophthalmoscope, and the retinæ found to be natural excepting slight venous congestion. When I first saw this patient, six months after the discovery of albumen, he had been subject to these attacks for three years, and had had about a dozen. Since the albumen was found, there had been occasional aching in the loins. The point which had attracted most attention was the general complete absence of albumen in the urine passed in the morning; while after breakfast and during the day there was a coagulum which varied from a fifth to a tenth, according to the nature of the food, most with meat, less with vegetables, least with milk. Oxalate of lime was generally abundantly present; never casts. When I first saw him, in the August of 1880, there was no trace of œdema or of cardiac hypertrophy; the pulse was soft and natural; the urine on rising was natural in appearance, had a specific gravity of 1025 and not a trace of albumen; some passed in my room gave with heat and acid a bulky coagulum.

This gentleman made several voyages to Australia as surgeon to a ship, for the purpose of recovering his health, which he succeeded in doing. After the first I found only a twelfth of albumen in the after-breakfast urine; after the second barely a trace, the early-morning urine remaining free as heretofore. He now (May 1881) had completely lost his anæmic look, and was apparently well in all respects. I advised him to practice in a warm climate, mentioning the South of France:

finding no good opening there, he went again to Australia, and finally to Aix-les-Bains. I last heard from him from this place in May 1884. He had remained perfectly free from albuminuria since the last visit, and was still in perfect health.

Albuminuria from changes in the blood irrespective of renal disorder.

Albuminuria from blood change, independently of any structural or dynamic alteration in the kidney, sinks into the more narrow compass the more closely it is examined.

It has been shown that all extraneous poisons which make the urine albuminous do so by way of renal irritation; the febrile conditions, including pneumonia and cholera, frequently as they cause the same change, appear to do so in association with tubal disturbance. Putting aside these causes of transient albuminuria, and also those in which, like heart disease, dyspnœa and ague, we recognise operations of venous congestion or increased blood pressure, there remain few conditions in which this state of secretion can be unequivocally traced to changes in the composition of the blood.

Among the most simple of these is the albuminuria which some observers have testified to as the result of the large ingestion of egg albumen. Berzelius found that, if white of egg were injected into the veins or cellular tissue of animals, the urine became albuminous; Claude Bernard noticed the same result in his own person from the eating a number of hard eggs after long fasting; and that raw eggs may produce the same effect is testified to by Brown-Séquard and other observers. Some experimenters, like Stokvis, have taken white of egg largely without finding any albumen in the urine, but this only proves that the power of assimilation differs in different persons. Alimentary albuminuria must hold its place as experimentally possible, though not as clinically frequent. It has been stated that the urine has become temporarily albuminous as the consequence only of dyspepsia; but, knowing as we do how often inconstant or periodic albuminuria together with dyspepsia is the accompaniment of an early stage of the granulating kidney, particularly when this is connected with gout, we can but suspect that when the urine has become albuminous with symptoms of indigestion, the kidneys may not have been perfectly sound. Temporary albuminuria has further been attributed to the rapid absorption of large serous effusions, but the evidence on this point is by no means conclusive. In modern experience, considerable collections of this sort are taken up without any such result, and we may suspect that when the urine has become albuminous in such circumstances, there has been some renal disturbance, either from blisters, as suggested by Dr. Warburton Begbie,[1] which in some instances had been recently applied, or connected with pneumonic or other change.

Hydræmia.

Mere hydræmia has been thought capable of making the urine albuminous. The well known experiments of Mosler[2] and Kierulf demonstrated that this result could be produced by the injection of water into the veins, but the further observation of Stokvis, that the effusion of albumen could be prevented by withdrawing a quantity of blood equal to that of the water introduced, was enough to show that the result was generally due, not to the dilution of the blood, but to the increased distension of the vessels. But so much water could be introduced as to partially dissolve the corpuscles, and give rise to the escape of their colouring matter together with globulin and albumen, as with hæmoglobinuria of morbid origin; but irrespective of such discharge, and without increasing intra-vascular tension, the addition of water does not make the urine albuminous. The rapidity, indeed, with which healthy kidneys will discharge any excess of water which is introduced by the stomach, without any accompaniment of albumen, is enough to show that albuminuria from excess of water in the blood has, at least in the human subject, no practical existence.

Albuminuria, as connected with intermittent hæmaturia

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[1] Observations by Heller, commented on by Dr. Warburton Begbie. *Med. Chir. Rev.*, 1853, p. 57.

[2] *Dict. de Méd. et de Chir. Pratiques*, p. 335.

Purpura and scurvy.

or hæmoglobinuria needs no further notice here. The urine in this condition contains albumen, along with the other matters of the corpuscle, and will even remain albuminous after it has ceased to be coloured; this, however, is probably due to the glandular irritation sequent upon the abnormal discharge. Next come conditions of purpura and scurvy. With purpura blood is often largely discharged with the urine, and, as with intermittent hæmaturia, may remain albuminous after it has ceased to be bloody. It is possible, again, in this case, that some degree of tubal disturbance has been set up by the passage of the blood. It is said that a similar condition of urine sometimes accompanies scurvy; and in the same category, that of albuminuria associated with, and dependent upon, hæmorrhage, may be placed those instances in which blood, whether in shape or solution, is discharged with the urine in connection with the more malignant types of small pox, scarlatina, and other febrile disorders. It is said that in such cases the blood is discharged in a state of solution, as with intermittent hæmaturia; if in such cases albumen appears without the colouring matter, it must with probability be attributed to the occurrence of such transient nephritis as febrile conditions are apt to set up.

Pyæmia and septicæmia.

With regard to the albuminuria of pyæmia and septicæmia, the kidneys are frequently the seat of pyæmic localisations, and the urine gives evidence accordingly of renal inflammation. As to less definite conditions of blood-poisoning to which the term septicæmia has been applied, these are sometimes associated with erysipelatous inflammation and attendant nephritis, and sometimes have a purpuric character, together with which hæmorrhagic transudation may take place into the urine. Further than this, Mr. Henry Lee[1] has drawn attention to the appearance of albumen in the urine often together with the colouring matter of the blood, but without corpuscles, in cases where clot or effused blood has been absorbed after accidents or injuries. We know that blood may be taken up without this result; probably the absorbed matter thus ejected has become, from decomposition or otherwise, unfit for the uses of the system.

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[1] 'On Albumen in the Urine, sometimes in conjunction with the colouring matter of the blood, as a consequence of surgical diseases and operations.' by H. Lee. *Lancet*, Aug. 21, 1869, p. 262.

Albuminuria consequent upon hepatic disturbance.

There are certain observations which would seem to indicate that derangement of the liver alone may cause the discharge of albumen by the kidneys. I do not refer to the common albuminuria of jaundice, with which the escape of bile by the kidneys creates an obvious condition of tubal nephritis, as evinced by the discharge, together with albumen, of bile-tinted epithelium and tube-casts—this has been considered elsewhere—but to a possible albuminous discharge by the kidneys as a consequence of hepatic independently of renal disturbance.

The following case suggests the question without providing the answer.

Case of recurrent albuminuria with vomiting and jaundice.

The wife of a medical friend, a young lady with the delicately pink complexion and slender frame which is suggestive of tubercular proclivities, though without evidence of tubercular disease, became subject to attacks of prolonged and violent vomiting which lasted for several days; were attended with the discharge, first of bilious, and then of slimy, colourless fluid; caused failure of the pulse, coldness of the extremities, greyness of complexion, shrinking of feature, and, in a word, a state of collapse almost like that of Asiatic cholera.

These attacks frequently commenced with the vomiting of a decided but not very large quantity of black blood; it was further noted that they were particularly apt to occur at the time of the monthly period, and that the hæmatemesis always ceased on the establishment of the uterine discharge.

There was no disturbance of the bowels with these attacks, and nothing was noticed to suggest their nature, until a suspicion that they might be uræmic led to the discovery that the urine during one of them was nearly solid with albumen; it was, however, in fair quantity, of good specific gravity, of full normal colour, and was evidently a rich secretion rather than in any respect poor or insufficient. No casts were found.

The marvel of the case declared itself in the rapid and total disappearance of the albumen after the vomiting had ceased; a week, or thereabouts, sufficed to restore the urine to a perfectly normal condition; and it thus remained until the next attack, when precisely the same series of changes was repeated. There was never any œdema. The attacks recurred at intervals of three or four months, occasionally thought to have been brought on by cold or fatigue, but usually without suggestion of cause. In the intervals the patient gave no sign of being otherwise than well, though examined, as her position ensured, with more than ordinary care. I am unable to say how early in each attack of vomiting the albumen made its appearance. Each of the attacks of which I was a witness had persisted for a day or two, and caused some degree of collapse before I saw the patient: the urine was then always such as I have described—nearly solid with albumen. When the attacks had recurred for about two years, it was noted that with each, as had not previously been the case, was a slight tinge of jaundice; and with this were pain and tenderness, neither severe, about the hepatic region. No enlargement could be here felt; the hepatic dulness, indeed, was thought to be less than normal, but not markedly so. At last occurred an attack in which the stress of vomiting produced a degree of prostration from which there was no recovery.

The attacks were quite unconnected with any disturbance of the bowels; these were at such times usually confined; the motions, when obtained, not abnormal.

The intermittent habit of the albuminuria, the general qualitative sufficiency of the urine, and the total absence of constitutional signs of renal disease show unmistakably that the vomiting was not uræmic. What it was is not clear.

There was a total absence of local head symptoms, of delirium, of convulsion, and of everything that could point to the nervous system as the source of the sickness. Were the attacks of hepatic origin? The slight jaundice and the hypochondriac pain suggest that they may have been so, and that possibly the transient albuminuria was due to hepatic lesion. We know that the urine sometimes becomes albuminous as a result of yellow atrophy of the liver; and though there is yet much to be learned, there is reason to believe that temporary albuminuria may be due to a failure on the part of the liver to deal according to its function with the albuminous matters which are conveyed to it.

According to present views, the liver receives albumen and converts it, among other things, into urea. It is probable that in certain morbid states of the organ the albumen may issue unchanged, to superabound in the blood and escape by the kidneys. Such a view corresponds with the discharge in this case of albumen without casts, as if mere albumen, and not liquor sanguinis, were escaping.

CHAPTER XXIII.

HÆMATURIA.

Blood may become admixed with the urine in so large a variety of circumstances that it may be well to classify them, to name the more important, and to indicate the clinical distinctions by which the classes at least are separated. It is not needful to dwell upon the changes produced in urine by the presence of blood, further than to indicate the differences which attend differences of origin. It is sufficiently known that the colour which blood imparts to urine is smoky or brown, if the mixture be acid; pink or reddish, if it be alkaline. Blood corpuscles, which readily fall to the bottom, and in acid urine long retain an outline which, though possibly not unaltered, is recognisable with the microscope, furnish the best test which exists for blood in minute quantity. Small quantities, even, can be discerned by the unassisted but practised eye, as a brown line which the corpuscles present at the bottom of a slowly tilted vessel. The corpuscles may be abundantly evident, while the albumen is inappreciable. Similarly, the colour of blood in urine is strongly marked, and is associated with an amount of albumen, supposing the albumen to be only that belonging to the blood, which often falls short of the expectation which the depth of colour has raised.

Means of detection.

It is not necessary to refer to the spectroscope[1] as a test for ordinary blood in urine, since other means of

The spectroscope.

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[1] See paper by Drs. Forrest and Finlayson, on 'Spectroscopic Examination of Urine in Hæmatinuria.' *Glasgow Med. Journ.*, 1879. Also the Spectroscope in Medicine, by Dr. McMunn.

examination are more easy and more accurate; it has been used with hæmoglobinuria to declare its analogy with common urinary hæmorrhage or indicate minute points of difference. The results are not very conclusive.

The guaiacum test.

The guaiacum test has its uses, the chief of which is the detection, not so much of blood in its entirety, as of the crystalloids, the transudation of which into the urine may precede or stop short of actual hæmorrhage or even of albuminuria. Dr. Mahomed[1] connects the guaiacum reaction with increased arterial tension, and relies upon this test to define a pre-albuminuric stage of albuminuria. If it should prove that this reaction is generally to be recognised before albumen, it would have a practical value which, perhaps, we are hardly yet warranted in assigning to it. It is at least evident that the guaiacum reaction is more often afforded by albuminous urine, in which case it adds little to our knowledge, than by non-albuminous. I examined 12 cases of each sort, taken by chance from among hospital patients. None of the non-albuminuric cases gave the reaction in question; it was found in 7 of the albuminuric. The non-albuminuric class comprised several varieties of disease of the heart and vessels, pneumonia, bronchitis, pleurisy, asthma, and several forms of paralysis. The albuminuric series included acute and chronic nephritis, the granular and the lardaceous kidney, and albuminuria from cardiac congestion. The reaction was given in 3 cases of acute and 4 of chronic disease. It was absent in the case of cardiac congestion, and in that of lardaceous disease. The test can scarcely have practical utility except when albumen is absent but expected.

Distinctions of origin.

The forms of hæmaturia may be first considered in relation to the source of the blood—whether from the kidney, the bladder, or the urethra—and, secondly, if it be derived from the kidney or bladder, whether it be dependent on local or systemic disease. Blood from the kidney is, as a rule, uniformly mingled with the urine, which is as bloody at the beginning as at the end of micturition. Distinct or tangible clots are exceptional as results of renal hæmorrhage, though, in particular when the kidney has been lacerated by violence, the urine may exhibit casts of the ureter in coagulum or small clots of indefinite shape. The sediment in general is a brown powder, which presents no shape except to the microscope. When separate clots are seen, the blood is usually from the bladder, prostate, or outward passages; when they are of large size, it is invariably so. Thus the presence of considerable clots is nearly conclusive against renal hæmorrhage, though the absence of clots proves nothing. Blood from the bladder is most abundantly passed at the end of micturition; the first urine may be natural in appearance, the last a mere collection of sanies and clot. Outside the body vesical blood is less intimately mixed with the urine than renal, and preserves a more sanguineous appearance. Blood from the urethra, which has little importance medically, is, or at least may be, discharged separately from the urine and independently of micturition. These leading distinctions will be assisted by such evidence of renal disease as is afforded by the existence of albumen disproportionately to the blood, or by the presence of blood-casts, which may possibly indicate the exact source of the hæmorrhage. The vesical or prostatic origin of the blood may be warranted by the urine being ammoniacal, by its depositing triple phosphatic and tenaceous mucus along with the blood, and not least conclusively by its displaying 'cancer' cells, or cells of the epithelioid type in such abundance as to indicate a growth. 'Cancer' cells often come from the bladder, but almost never from the kidney, the growths in which are commonly sarcomas, the cells of which are not shed whole and abundantly as those of carcinoma are apt to be, but come away, if at all, impalpably.

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[1] 'The Etiology of Bright's Disease and the Pre-albuminuric Stage,' by F. A. Mahomed. *Med. Chir. Trans.*, vol. lvii.

I have dwelt chiefly upon the distinctions which may avail when more obvious signs of the nature of the disease are wanting. It may be that local or constitutional symptoms point so unequivocally to one organ that there is no room for speculation. The evidences of acute nephritis, of renal tumour, of stone, intermittent hæmaturia, purpura, or scurvy may be beyond doubt. Dropsy may be equivocal—either a result of hæmorrhage or a sign of renal disease. In a doubtful case it is well to look narrowly for 'bladder symptoms'—vesical tenderness, pain in the bladder or penis, frequency of micturition, or pain after it.

The chief varieties of hæmaturia may be stated in a tabular form, with further reference only to those points of difference and to such circumstances as call for separate mention.

Dependent on Conditions of the Urinary Organs.

From conditions of the kidneys	Injuries—bruises and lacerations.
	Albuminuric changes of any kind, especially nephritis.
	Associated with the albuminuria of pneumonia, cholera, and the specific fevers.
	Congestion from heart-disease or other mechanical causes.
	Embolism.
	Renal pyæmia.
	Renal disseminated suppuration (surgical kidney).
	Tubercle.
	Villus.
	Malignant growths—sarcoma, carcinoma.
	Stone.
	Strongylus.
From conditions of the bladder, prostate, and urinary passages	Injuries, surgical or accidental, of bladder.
	Stone.
	Tubercle.
	Growths, chiefly carcinoma, papilloma, or villus.
	Varicosity or local change in mucous membrane, nævus.
	Simple congestion.
	Cystitis from any cause—gout, paralysis, febrile prostration, &c.
	Enlargement or disease of the prostate.
	Stricture or inflammation of urethra or use of instruments.

Of uncertain or various seat, or common to several positions	Simple hæmaturia (?).
	Hæmaturia caused by mental emotion (?).
	,, ,, ,, bodily exertion.
	,, ,, ,, sexual excess.
	,, vicarious of menstruation (?).
	,, ,, of hæmorrhoidal flux (?).
	,, due to action of irritant poisons, cantharides, &c.
	,, ,, hydatids.
	,, ,, bilharzia.
	,, ,, chyluria (blood in this case probably derived from bladder).

Dependent on General Conditions.

Associated with	Hæmophilia.
	Scurvy.
	Purpura.
	Hæmorrhagic condition, sometimes associated with fevers—small pox, typhus, &c.[1]
	Relapsing fever.
	Remittent fever.
	Ague.
	Intermittent hæmaturia or hæmoglobinuria.

Renal hæmaturia.

Bleeding from the kidney tubes may occur in connection with any disease of the secreting tissue which gives rise to albuminuria. It is most severe and continued with nephritis, especially from cold. This bleeding, though not of bad omen as regards the result, is often profuse and obstinate; the urine may be nearly black with blood for weeks, and the loss such as much to aggravate the anæmia proper to the disease. But the symptom need not greatly modify the treatment otherwise called for, or give rise to much anxiety. I think, indeed, that with free bleeding lasting disease is less apt to ensue than when there is none. The astringent salts of iron are of use, and may be associated with sulphate of magnesia or sulphate of potash, so as to relieve local congestion and ensure free action of the bowels. Hæmorrhage sometimes occurs, occasionally rather than continuously, with the granular kidney, and is probably a result of intercurrent attacks of nephritis. With lardaceous disease bleeding is less frequent and less profuse. Albuminuric hæmorrhage is generally easily recognised by the casts which accompany the blood; these will probably contain blood corpuscles, or will at least display the brown colour of blood if not its distinguishing forms. Hæmorrhage of similar origin is sometimes a result of the congestion of heart-disease, though in this case it is less persistent. Blood is sometimes found in the urine with all the specific fevers, the more often with the more severe. The hæmorrhage is generally renal in origin and due to inflammation of the kidney or congestion akin to it; occasionally it depends on the condition of blood rather than of structures, and then may proceed either from the kidney or the mucous surfaces. Enough has been said with regard to the nephritis of scarlatina, measles, and erysipelas, and the hæmaturia which so often attends it. Typhus may be similarly accompanied, the kidneys presenting, after death, the appearances of acute nephritis. Together with albumen epithelial and blood-casts may have been found in the urine, and even blood in conspicuous amount, the latter addition being, according to Dr. Murchison,[1] a dangerous sign, connected possibly with a state of blood as well as of kidney. The same evidences of renal inflammation are associated, though less frequently, with typhoid, copious hæmaturia having been met with for the most part in conjunction with other hæmorrhages.[2] A similar association is sometimes, though fortunately not often, seen with small pox. Often as the urine is albuminous with this disease, it is seldom bloody, though it is apt to be so in the malignant form, in which hæmorrhages occur from the mucous surfaces and in other situations.

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[1] These conditions are commonly associated with nephritis, and appear also in another part the table.

Another source of hæmaturia, as the result of typhus, and possibly also in connection with other fevers, is to be found in cystitis, the result of neglected retention.[3]

With yellow fever, as with other specific[4] and contagious fevers, albumen casts and blood have been found in the urine, apparently in connection with associated nephritis.

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[1] *Treatise on Continued Fevers,* 2nd edit., p. 156.

[2] *Ibid.*, p. 533.

[3] *Ibid.*, p. 212.

[4] Article on 'Yellow Fever,' by J. D. Macdonald, M.D. Reynolds' *System of Medicine*, ed. i., vol. i., p. 669.

Relapsing fever is an occasional cause of copious hæmaturia. Dr. Murchison[1] observed the urine to be largely bloody, and to contain albumen and blood-casts, in both paroxysms of this disease, while during the interval it was free from even a trace of albumen.

Toxic hæmaturia

Connected with renal inflammation, though often transient, sometimes coincident with a similar condition of the pelvis or some other part of the urinary mucous membrane, is the hæmaturia of irritant poisons, represented by cantharides and turpentine. Bleeding of this origin is apt to occur together with much vesical irritation. It is not necessary to add to what has been said in connection with toxic albuminuria (page 338) and abscess from cantharides (page 635).

Blood in the urine often marks the impaction of an embolic block in the kidney, but neither in this case is it of long continuance.

From stone and growths.

The renal hæmorrhages of the greatest practical importance (putting aside for the present that of intermittent hæmaturia or hæmoglobinuria, which, though renal in source, is not so in cause) are those which belong to stone and tumour. The means of distinguishing them have been detailed under the heading of *stone* (page 925). The influence of rest in stopping bleeding from stone supplies the most useful guide. The bleeding from stone is less profuse and more transient than that from tumour, though sometimes, when rest is not attainable, it is such as to cause pallor and call for iron. I may here mention two observations with regard to the bleeding of stone, which have not found place elsewhere. Though it be brought on by movement, it does not always ensue immediately, but an interval of a day or more may possibly elapse. It will sometimes follow the free use of alcohol; I have known it to do so with such constancy that an attack could be brought on at option with beer.

Growths to bleed must ulcerate into the pelvis. They then cause hæmorrhage which is more profuse, persistent, and unmanageable than that from any other cause in which the kidney is concerned; nevertheless, it occasionally happens that the discharge will intermit or come to an end spontaneously, or apparently give way to the last remedy. I have seen remission more often sequent upon iron alum or tannate of iron than from ergot or any other styptics. Ergot is of more use with the vessels of a normal structure than with those of a growth. The great thin veins of such sarcomata as belong to the kidney probably have little contractile power. No casts are to be found in blood of this source, but only blood corpuscles, with perhaps some amorphous powdery sediment. Cancer cells, or morbid cells of any kind, are conspicuously absent; unlike what occurs when the disease is in the bladder, when they are often abundantly present.

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[1] *Treatise on Continued Fevers*, p. 369.

The hæmaturia of hæmophilia appears to be of renal origin, if preceding pain in the back is to be taken in evidence, and is probably due to some such attenuation of the renal blood-vessels as has been observed in other parts. Whether casts appear in these circumstances, or in what guise the blood presents itself, I have never had an opportunity of ascertaining. There is at least one instance on record in which this manifestation of the hæmorrhagic diathesis has caused death.[1]

Vesical hæmaturia.

Diseases of the bladder and prostate yield blood to the urine perhaps less persistently, but on occasion more profusely, than do those of the kidney.

Case of profuse bleeding from cancer of bladder.

I think the largest amount of blood I ever knew to be discharged with the urine was in the case of a gentleman whom I saw at Manchester with Dr. Lloyd Roberts, whose bladder, as was ascertained after death, was the seat of a ragged cancerous growth of little thickness, and about two and a half inches in diameter. This gentleman began to pass blood with the water in occasional small quantities, without pain, frequency, or discomfort, rather more than five years before his death. After two and a half years of this he had a sudden profuse hæmorrhage, which was followed by retention of urine and much vesical distress, with pain in the penis and perineum. Dr. Roberts passed a catheter, and broke up and evacuated with immediate relief a quantity of coagulum with which the bladder was filled. At a later epoch a recurrence of similar symptoms made it necessary to repeat this operation. After the first profuse hæmorrhage the attacks were repeated every two or three months—being brought on sometimes by an effort, such as lifting, coming on sometimes insidiously in the night, the patient waking to relieve the bladder, but passing only blood, or what looked like it. The blood was often passed, apparently unmixed, after the urine, which itself had presented a perfectly natural appearance. During the attacks there was much vesical irritation, in the intervals none. For the last year the bleeding was nearly continuous. When I visited him two months before his death every vessel in his bedroom was full of blood or blood-like fluid, with large clots at the bottom of each. The patient described graphically the trouble he had in expelling these, which were often six inches long, and were shot out only after much straining. Some were so bulky, indeed, that it was difficult to believe that they had passed through the urethra. He was blanched, emaciated, and prostrate, as after such loss of blood he could not fail to be. Under the tannates of iron and alumina, gallic acid and perchloride of iron, together with the rest in bed which was now inevitable, the bleeding finally ceased, leaving the urine clear, albuminous, and with a plentiful deposit of epithelioid cells, which were presumed to have come from the bladder, but could have scarcely have come from it in such abundance but as the results of a morbid epithelial growth. These were of large size, round, pear-shaped, and irregularly elongated and tailed. Without further bleeding the patient gradually sank, death being due rather to the constitutional than to the local consequences of the disease.

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[1] In the case of a boy eight years old, quoted from *Grandidier* by Dr. Wickham Legg. *Treatise on Hæmophilia*, p. 53.

Such hæmorrhage from any cause is exceptional; from cancer of the bladder it is often scanty, and for long periods absent. As a rule, the bleeding of villous growths which may not be malignant is more profuse, and may be directly fatal, which that of cancer seldom is. Large quantities of blood, scarcely changed by the urine, and containing large clots which have formed in the bladder, and often been expelled thence with difficulty, issue as the result of this condition. Rare as villus is in the kidney, it is common in the bladder. It is readily identified by the finding with the microscope of loops and filaments of vascular structure often entangled in coagulum. These should be looked for, repeatedly if necessary, in a case of profuse vesical hæmorrhage. Villus is almost always of the bladder, though this formation has been known to be associated with solid malignant growths in this situation or in the kidney. Such a concurrence is too rare to form an exception of any practical importance to the rule that villus is innocent. And it may be added that it is very amenable to astringents, especially if locally applied.

Hæmorrhage from villus of bladder.

A fat man of 50 was under my care in St. George's Hospital in the year 1867 with profuse hæmaturia, vesical in character; the blood was accompanied with large clots, which were expelled, however, without much difficulty; and large epithelial cells, such as might have come from the bladder, were found with the microscope. The hæmaturia was constantly present for rather more than a month, at the end of which he was anæmic to the last degree and œdematous. After one injection of the tincture of the perchloride of iron (two drachms to eight ounces of water) the bleeding abruptly stopped, the next urine being free from blood. The hæmorrhage reappeared for one day three weeks afterwards, but with this exception remained absent. The patient rapidly regained the appearance and sensation of robust health, and then went his way. Seven years afterwards he had a recurrence of the same symptoms, came again into the hospital, was treated again with the perchloride with same result as regarded the hæmorrhage, save that one or two small coagula could still be seen in the urine. But the urine was now albuminous independently of blood, and he died in coma, the result of concurrent kidney disease. A papillamatous growth, which might equally well have been described as villus, was found in the bladder.

The readiness of villous growths to become detached gives capriciousness to their course, and adds complication to their symptoms. Portions, or even the whole, will sometimes break away and leave the patient thus cured, or at least completely relieved. A gentleman who suffered from an issue of blood of this nature became the subject of a medical consultation.[1] During this he had an urgent call to pass water, and discharged in response to it a quantity of nearly pure blood, and with it the villous growth in regard to which he had sought advice. The riddance seemed complete, and with it the cure; but in ten years the disease returned, and ended fatally. A brother of this gentleman died of the same disease. I have known a portion of a villous growth to become detached, but remain in the bladder to become encrusted with phosphates, and set up independently as a stone.

I need not dwell upon the forms of vesical hæmorrhage which more often come under the notice of the surgeon: those connected with stone and with enlarged prostate are the most common. That from stone is small and repeated rather than profuse; it is often only microscopic in amount. Its obvious dependence upon bodily movement is enough to distinguish the hæmorrhage belonging to stone in the bladder from that due to any other affection, save stone in the kidney; and with this it can scarcely be confounded. Enlarged prostate gives rise to more profuse bleeding than any other vesical affection, putting aside morbid growths; large quantities of dark blood, which, as far as I have seen, has less tendency to clot than that derived from cancer or villus, are thrown out from this source in separate outbreaks rather than continuously. The bulk of the blood passes from the bladder with the urine; a few drops usually alone after the bladder is empty. Bleeding of this origin is usually associated with the other concomitants of prostatic disease—advancing age, frequency of micturition, pressure on the rectum—which will be sufficiently significant of its source. I need not dwell upon the treatment of this form of hæmorrhage: sulphate of magnesia and other saline purgatives will relieve the congestion on which it depends;

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[1] The consultants were Sir W. Gull and Sir Prescott Hewett; the latter my informant.

ergot may be used with advantage, and ice introduced into the rectum should other measures fail.

Among the rarer causes of hæmaturia may be mentioned vesical nævus. A child[1] with a malformed bladder and a large 'mother's mark' on the pubes passed blood in its urine. It died eight days after birth, and a number of prominences of vascular tissue like that of a nævus were found upon the vesical mucous membrane.

Case of hæmaturia attributed to nævus.

I have lately seen a case presumably of this nature. A gentleman of the age of 33, apparently in robust health, has had, since the age of 16, three or four attacks of hæmaturia a year; the bleeding commonly presented itself with three or four micturitions, and then completely ceased until next time, the urine in the intervals being perfectly natural. The urine which came under my notice, in a fit of unusual severity in which large clots had been expelled, looked like pure blood; numbers of large spheroidal nucleated cells were seen with the microscope, such as might have come from the bladder. There was some uneasiness and tenderness in the vesical region, and a small quantity of blood, unmixed with urine, had often been noticed to leak from the urethra with straining at stool. The bleeding was never brought on, or increased, by even violent exercise. This gentleman has five children, four of whom have external nævi, and it is to be presumed that he has a formation of the same nature in connection with the bladder or prostate. The bleeding has hitherto stopped spontaneously, or under the influence of styptics, chiefly ergot, by the mouth. The injection of the perchloride is, perhaps, in the future.

Vicarious hæmaturia.

Hæmaturia, like most other hæmorrhages, has been thought to be vicarious of menstruation, and on doubtful evidence. It has, at least, never been my fortune to trace the urinary flux to this cause. And whether such bleeding is ever vicarious to that of piles may be also taken into question. The bleeding of piles is related to that from the stomach and bowels by a common origin in cirrhosis, and a common source in the portal vein; but the vascular circumstances of the kidney are different, and the connection of renal hæmorrhage with that of piles at least remote.

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[1] Reported by Mr. T. Holmes, *Path. Trans.*, vol. xvi., St. George's Hospital Museum, series xii., prep. 115.

Mental emotion.

A discharge of blood with the urine has been said to supersede asthma and to be caused by mental emotion; of the first I have no experience; with regard to the second, I may mention the case of a skilled medical observer, now in his fifth decade, who attributes the recurrence of small urinary hæmorrhage in his own person to excitement or mental tension. For twenty-three years he has been liable to occasional bleedings of this sort, about eight attacks in a year at most. These were noticed as occurring with especial frequency after lecturing; in the year of their greatest frequency five of the eight took place immediately upon the conclusion of this effort. It seemed probable from the character of the hæmorrhage that it was prostatic or vesical.

Purpura and scurvy.

Purpura and scurvy are causes of hæmaturia which are generally made clear by the concomitant symptoms. With purpura, blood is often liberally extravasated into the renal tissues. I have traced it in cylinders, and otherwise between the convoluted tubes, and in the areolar tissue, especially that part of it which surrounds the pelvis. Blood is sometimes to be traced in such close connection with the pelvic mucous membrane as to suggest that this must have given issue to the discharge, and probably the vesical membrane also may sometimes give exit to it. I have found blood also in the renal tubes and blood-casts in the urine, so that the hæmorrhage may present all the characters indicative of its renal origin. The extravasated blood is corpuscular, as a rule, though it is said that in cases of exceptional severity, both of purpura and scurvy, it has appeared in the dissolved state to which the term hæmoglobinuria has been given. Of this I have had no experience. It may be added, to complete in this place as much as need be said of renal purpura, that beyond the appearance of blood in the urine, there are usually no symptoms to point to the local change. A marked example under my observation was in a case of general purpuric extravasation connected with jaundice and obstruction of the common hepatic duct by hydatids. The kidney was deeply yellow and liberally dotted with interstitial ecchymoses. It is not necessary to particularize the treatment needful for purpuric hæmaturia, which is that of the primary disorder.

Hæmaturia of infants from improper food.

Infants who are brought up by hand, especially when milk has been withheld or insufficiently given, are liable, at about the time of teething, to a form of hæmaturia which cannot be described as otherwise than scorbutic, though the superficial ecchymoses may be slight or even absent, and there be no discharge of blood save with the urine. I have lately been consulted in five such cases, and made aware of a sixth. The children varied in age when attacked from 4½ to 11 months. In all the diet had been conspicuously wanting in fresh milk; the substitutes which were employed will be presently indicated. The urine in every case had a full sanguineous colour, remained so for many weeks, and ceased to be so under the influence chiefly of milk. The blood in each case was corpuscular; the urine not albuminous, save in one instance, beyond what was apparently due to the blood; casts were found in three cases, while in the others large epithelial cells, with more or less mucus or pus, suggested that the blood proceeded from the urinary surface rather than from the kidney substance.

In June 1880 I saw, with Mr. Tapson, a female child, aged 8 months, who had for one month been passing urine mixed with blood to the colour of port wine. The blood was generally present, though not invariably; it was uniformly mixed with the urine. No casts could be found, but some large epithelial cells from the bladder or passages. No clots had been passed. The urine coagulated with heat and acid to the amount of one-tenth. The child was pallid; no purpuric spots nor any change in the gums existed; it had no evidence of abdominal tumour, nor could any malarial influence be traced. It had been brought up by hand upon Nestle's food mixed with water, with the recent addition of a little meat juice. Fresh milk was now liberally given, and a little ergot and perchloride of iron. The child rapidly and completely recovered.

With regard to the second, I was consulted by the late Dr. Lyster, of Liverpool. The child, a female of the age of 6 months, had passed bloody water since the age of 4½ months; she had been brought up chiefly on Nestle's food. The urine contained blood with some epithelial cells and pus globules, but no casts. There were very slight ecchymoses on the knee and sacrum, but no sponginess of the gums, nor hæmorrhage elsewhere than with the urine. Ergot appeared to have done some good, iron none. Pure fresh milk was then obtained, at my suggestion, and the child fed chiefly upon it. Within a week of this change the wasting, which had before been marked, ceased, the hæmorrhage stopped, and the purpuric spots disappeared. She was soon perfectly well.

The third case was that of a female child 8 months old, who had been brought up entirely by hand upon Nestle's food and Swiss milk. For three months she had passed water red with blood, containing epithelium, such as might have come from the bladder or pelvis, but no casts. She had had purpuric patches behind the ears, and the gums had been spongy and purple, as if about to slough. It was observed by Dr. Stanley Smith, with whom I saw her, that the hæmaturia increased whenever a tooth was about to emerge from the gum. Under abundance of fresh cow's milk, ergot, and perchloride of iron, she steadily improved, and ultimately recovered.

In January 1884 I saw, with Mr. J. C. Merriman, a male infant aged 10½ months, whose urine had become bloody three weeks before, and so remained. There had been no frequency or sign of local irritation. The urine was alkaline, of a full pink colour from blood, which was entirely corpuscular. Beside the blood-corpuscles were a few casts, some containing blood-corpuscles, others faintly granular. There was no more albumen than the blood would account for. The child was anæmic and rickety; there was no soreness of the gums nor purpura. On inquiry I found that the child had been partially suckled for the first three months, Swiss milk having been given in addition. For the next two months the food consisted wholly of Swiss milk; then of Nestle's food until six weeks before I was called in, when it had in addition sago boiled in cow's milk, the amount of fresh milk thus given not exceeding a quarter of a pint a day. From the age of 3 months to that of 9 months no fresh cow's milk was given, but only Swiss milk and Nestle's food. A change of diet was at once made, a quart of fresh cow's milk and a little freshly-made beef-tea being given every day in the place of what had been employed previously, and two minims of the tincture of the perchloride of iron three times a day. The blood immediately disappeared from the urine, and four days after our consultation the urine, as I was informed by Mr. Merriman, did not contain even a trace of albumen.

The fifth case was that of a boy a year old, whom I saw with Mr. Buée, of Slough. He had been brought up by hand, and as 'fresh milk did not agree with him,' this had been for the last four months totally excluded from the dietary, of which Swiss milk formed the staple. A fortnight before he was brought to me the urine became bloody. When I saw it, it was ammoniacal, of a full pink colour, albuminous to an eighth, more, as was thought, than the blood would account for, and displayed under the microscope multitudes of blood-corpuscles and a single waxy cast. Each thigh was the seat of a deep, painful swelling, which appeared to be in contact with the periosteum and hæmorrhagic. These, together with the cachectic look of the child, raised suspicion of syphilis, which, presuming that the swellings were hæmorrhagic, it was scarcely necessary to entertain. However, in addition to the essential change of diet, the iodides of iron and potassium were ordered. An Alderney cow, the milk of which was found not to cause vomiting, which bought milk had done, was obtained for the child's use, and from this moment it began to recover. The femoral swellings disappeared without suppuration, the hæmaturia ceased, and the child became well and strong.

Since my attention was drawn to this association in infants of bloody urine with unsuitable food, another instance has been brought under my notice by my friend, Dr. Abercrombie. Hæmaturia, together with spongy gums, came on under a diet limited to Nestle's food, Robb's biscuit, and water, and ceased under milk and water. In this case blood-casts were found, showing that the blood was, at least in part, of renal origin.

The circumstances of these cases, the presence or absence of superficial hæmorrhages and of changes in the gums, would permit some to be described as simple hæmaturia, others as purpura, others as scurvy. It is clear that all were of the same nature, however restricted the symptoms, and akin rather to scurvy than any other condition. They sufficiently show that Nestle's food and Swiss milk are not to be regarded as substitutes for fresh milk in the process of bringing up by hand, though as an addition to fresh milk and water Swiss milk can often be advantageously used.

Simple hæmaturia?

To allege the occurrence of simple hæmaturia, of hæmaturia unaccompanied by any alteration in blood or tissue, is almost to assert the existence of an effect without a cause. But, nevertheless, it is matter of experience that the urine will sometimes become bloody, slightly or profusely, and will so remain for a longer or shorter time, and then will cease to be so without our being able to obtain any clue as to the cause, either of the disorder or its cessation. Sometimes such hæmorrhage may be small and transient and apparently connected with some general liability to hæmorrhage, as shown by the frequency of slight nose-bleedings. In other instances profuse and even dangerous hæmaturia has come and gone thus inexplicably.

I saw with my friend, Mr. Manley Sims, a young lady who, with a remarkable absence of any other symptoms of local disease, had for about two months passed urine which looked almost like blood itself. It contained a few small shreddy coagula, probably from the bladder, but not impossibly from the kidney; nor was there any circumstance by which the source of the blood could be confidently localised beyond that it did not come from the vagina. The microscope showed natural blood-corpuscles, but no products more distinctive than some large epithelial cells, which might have been yielded either by the bladder or the pelvis. Rest in bed did not mitigate the discharge, nor did any of the customary styptics. The hæmorrhage stopped, after lasting six months and reducing her to an exceedingly anæmic condition, under a remedy of magical repute, the wych-hazel (tinctura hamamelis), employed by Mr. Sims after most of those in orthodox esteem had been given in vain. She is now (two years after the attack) in apparent health, passing water free from blood, though loaded with minute crystals of oxalate of lime. The persistence of the hæmorrhage, in spite of absolute repose, and the absence of pain, are enough, however, to set aside stone as its cause. It can only be suggested that the bleeding was from a villous growth, and ceased upon its breaking off or becoming impervious, as in instances previously referred to.

I could mention other cases in which free and protracted hæmorrhage with the urine has thus come and gone without declaring its nature, either by its characters or its sequelæ. Such hæmaturia, however, is not to be called simple but obscure. A non-malignant bleeding growth is the explanation which usually commends itself.

Malaria.

Malaria is a fruitful source of hæmorrhage. Whatever processes contribute to the extravasation, there is at least one agency, the results of which are simple and obvious, the driving of the blood out of vessels temporarily constricted into others that are not so. If it be that some burst or leak, it is only what is to be expected.[1] The liver has been found studded with clots of extravasation, the stomach and bowels with ecchymoses; extravasations have been found within and upon the walls of the heart, and in connection with the brain and the retina.

An amputated stump has been known to bleed periodically under the influence, as was thought, of a previously contracted ague, and to cease to do so under that of quinine.[2]

The association of bloody urine with malaria has long excited notice. Prout regarded this influence as predisposing to urinary hæmorrhage rather than directly inducing it, enhancing the effect of stones and bleeding structures, and making profuse what might otherwise be a slight discharge. The occurrence of hæmorrhage from the kidney during an ague fit is a matter of old, though not frequent, experience.[1] The voiding of bloody urine, after pain in the loins, at the neck of the bladder, and in the glans, was common with the severe intermittents which gave so large a mortality to the Walcheren[1] expedition. I have elsewhere referred to the experience of Dr. Elliotson upon this point, and there would be no difficulty in adducing that of other observers to the effect that malarial fevers, whether of the intermittent or remittent type, are occasionally productive of this hæmorrhage.[2] A form of malarial hæmaturia, after death from which blood is found in the kidney tubes, has been described by Dr. Joseph Jones, of New Orleans, as resembling yellow fever, but distinct from it;[3] and we have testimony from Mauritius of a 'paludal fever'[4] which appears to be irregularly periodic, in which the stage of rigor is regularly followed by renal hæmorrhage. The attack is accompanied by either a general condition of jaundice, involving the eyes and skin, or else extensive subcutaneous and submucous hæmorrhages of a purpuric character. We are not told whether the blood in the urine in these cases is corpuscular or disintegrated; but the deficiency is supplied by a case of fatal malarial fever contracted in Minorca, of which the particulars are given at page 1192, in which the symptoms, inclusive of the subcutaneous hæmorrhages and the yellowness of skin, indicate a similar condition. In this instance the urine was loaded with blood which was entirely disintegrated and in all respects characteristic of hæmoglobinuria the malarial origin of which is in question.

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[1] *Retinal Hæmorrhages and Melanæmia as symptoms of Ague*, by Stephen Mackenzie, M.D.

[2] *Intermittent Hæmorrhage from Malarial Influence*, by Surgeon-Major Porter. *Med. Chir. Trans.*, vol. lix.

Such cases, where definite malarial disease is accompanied

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[1] Dr. J. B. Davis on the Walcheren Fever, p. 37.

[2] See p. 1178. Also Herz on Malarial Diseases, *Ziemssen's Cyclopædia*, vol. ii. p. 641.

[3] See the *New Orleans Med. and Surg. Journ.* for February 1878. 'Observations on Malarial Hæmaturia,' by Dr. Joseph Jones, quoted in *Lancet* for April 20, 1878, p. 595.

[4] 'On the treatment of a severe form of Paludal Fever, with Icterus and Renal Hæmorrhage,' by J. Labonté, Port Louis, Mauritius. *Edin. Med. Journ.*, May 1875, p. 1006.

Hæmoglobinuria.

by the typically disintegrated urine, form an inseparable link between the hæmaturia of ague and the variously named intermittent hæmaturia, the recognition and the definition of which depend on the pulverisation of the blood-discs. The analogy between the attacks of this affection and of ordinary ague is sufficiently obvious. It is beyond question, as has been shown in another part of this volume (page 1161), that a significant proportion of those who suffer from this form of hæmaturia have either had ague or been notoriously exposed to the malarial influence. The point of inseparability between the two diseases appears to lie between ordinary ague, every recurring fit of which is accompanied by hæmaturia, and intermittent hæmaturia, the fits of which recur with regular periodicity. If it should prove, as I suspect it will, that the blood passed with ague is generally disintegrated, as in the case which has been cited, then it must be inferred that intermittent hæmaturia is but a variety of malarial fever.

The solution of blood-corpuscles in the body and the exit with the urine of the colouring matter together with albumen is not peculiar to intermittent hæmaturia, though characteristic of it; a lesser amount of blood pigment together with albumen has been found in the urine with various states of septicæmia and blood-poisoning, which have been sufficiently referred to. It would appear that any of the numerous agencies which tend to dissolve or disintegrate the blood within the body may give rise to more or less of this condition.

Treatment of hæmaturia.

The treatment of hæmaturia generally resolves itself into that of the diseases on which it depends. When from stone, absolute rest is of the first importance; when from growths, active movement should be avoided, though rest in bed is attended with little advantage. The kidney is not to be reached by cold superficially applied, or to be directly depleted from the loins; it may be influenced by styptics taken by the mouth, iron-alum, tannate of alumina, gallic acid, acetate of lead, wych-hazel, and ergot, or by the last of these introduced hypodermically. Local congestion may be lessened by saline purgatives—sulphate of magnesia, perhaps, the best for the purpose. This may be given, as a general rule, when the bleeding depends either on albuminuric disease or renal or prostatic congestion. Ice, though useless upon the loins, may be of service in the rectum when the bleeding is from the prostate or bladder. For malarial and intermittent hæmaturia, quinine in large doses and long continued is the remedy, often usefully associated with the astringent salts of iron. I need not add to what has been already said as to the necessity of fresh milk with the scorbutic hæmaturia of infants.

CHAPTER XXIV.

SUPPRESSION OF URINE.

Though suppression of urine as a symptom of renal disease has been referred to in various parts of this work, it may be convenient to place in juxtaposition the several disorders upon which it ensues, and the circumstances which attend the occurrence.

Suppression of urine may be conveniently considered as of two kinds: first, renal suppression, depending on disease of the kidney or of the urinary or vascular channels in immediate connection with it; secondly, systemic suppression, in which the gland, though natural in structure, ceases to act in consequence of an influence external to itself, which involves the whole system in its morbid operation.

Renal Suppression.

There are many conditions of kidney which are attended with partial suppression of urine; others in which the absence of urine is complete. As a rule, partial suppression depends upon disease of the secreting structure; total suppression upon a mechanical obstruction in the renal outlet.

From nephritis and other forms of albuminuria.

Partial suppression, or in other words extreme scantiness of urine, sometimes results as described elsewhere, from disease of the secreting substance of the kidney. With tubal nephritis especially the diminution is sometimes extreme. There is a rapidly fatal form of the disease, consequent upon scarlatina, in which the tubes become early and all at once filled with a fibrinous exudation.

The urine is usually free from blood, of a deep yellow colour and high specific gravity; it is generally loaded with albumen, though cases have been known in which under these circumstances albumen has been totally absent; and it abounds with strongly-defined fibrinous casts. This form of scarlatinal nephritis is illustrated in the case of Vallance (page 327). His minimum of urine in the twenty-four hours was 45 centimetres, or about an ounce and a half. Sometimes in similar cases the secretion is even more scanty, falling to a few drachms in the day, while less than an ounce daily is passed for several days together. Such cases are usually fatal by way of uræmic disturbance of the brain, though it may happen that this result is anticipated by one of the forms of acute inflammation, to which children with nephritis are especially liable.

The urine may also be remarkably diminished in that highly congestive nephritis which cold sometimes produces in grown persons. Under this condition the urine is always loaded with albumen, and of high specific gravity. It is generally black with blood and full of thick casts. The case of Benjamin Patrick (page 308), in which on one occasion only two ounces of urine were voided in the twenty-four hours, may serve as an example of this affection, while a still more striking instance is afforded in that of Lord Z——'s groom (page 311), who passed during the last five days of the disease only three and a half ounces of urine, the quantity for one day and night having fallen as low as five drachms.[1] This affection, like the scarlatinal form, is rapidly fatal, and as a rule by cerebral uræmia. Such affections of the kidney, much as they may lessen the production of urine, rarely cause total suppression, but it is worth remarking that though the suppression is but partial, death often ensues in shorter time than where as a consequence of mechanical obstruction the suppression is absolute. Towards the close of granular degeneration the urine may fall considerably below the habitual amount, and may even on the approach of death be absent for many hours.

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[1] See case of scarlatinal nephritis reported by Dr. Roberts in the *Lancet*, 1868, p. 655.

Case of suppression with glomerular nephritis.

As an instance of unusually prolonged suppression in connection with the early granular kidney, I may refer to a woman, who died at the age of 33, under my care in St. George's, with cerebral uræmia complicated with uræmic dyspnœa. The urine, which had been scanty, highly albuminous, and bloody, ceased to be passed. A catheter was used after eighteen hours of its absence, but none obtained. After a digitalis poultice and a hip bath about two ounces were thought to have been passed into the blanket in which she was wrapt; but for this the suppression continued until death, which occurred thirty-four hours and forty minutes after the last preceding urination. After death a catheter was again introduced, and the bladder found to contain about half a drachm of urine. The kidneys were large, the pair weighing seventeen ounces, the surfaces somewhat granular, the cortices somewhat pale, the malpighian bodies conspicuous. Microscopic sections showed that the blood vessels were full, the interstitial tissue thickly nucleated, and the tubes numerously plugged with strongly-marked casts; but in none of these particulars did there appear to be any peculiarity to account for the suppression. The malpighian bodies, however, suggested an explanation. Inside the capsule of each was a bulky inner case of nucleated tissue, which had intruded between it and the vascular knot, distending the one and compressing the other.

In an advanced stage of lardaceous disease the urine, once superabundant, may become very scanty: but there is seldom such diminution as has been recorded with other forms of albuminuria.

With disseminated or other suppuration of kidney.

Suppression, for the most part partial, but occasionally total for a short time, may occur when the kidney is the seat of suppuration, whether this be of the limited sort, which is occasionally produced by an external injury, or be disseminated as the result of pyæmia or of septic urinous absorption. A remarkable instance of disseminated renal suppuration consequent on scarlatina is related by Dr. Bates,[1] of New York, in which for the nine days preceding death the total of urine secreted did not amount to half an ounce. An instance of transitory suppression in connection with a traumatic abscess of the kidney is given from Rayer at page 631. The urine was absent during one day, the secretion reappearing on the following with the admixture of pus. Suppression in connection with renal pyæmia is exemplified in the case of William Long (page 641). The outset of the pyæmic affection in the kidney was marked by a suspension of micturition for forty-eight hours; at the end of this period five ounces of urine were removed with the catheter, so that the suppression was then only partial. The urine when obtained, and for the rest of the patient's life, was very deeply coloured and albuminous. Blood and pus corpuscles and cells of renal epithelium were seen both scattered and entangled in fibrinous casts.

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[1] *Med. Record*, Oct. 16, 1880, p. 431.

Those cases of renal abscess in which the suppression, though usually incomplete, may for a short time be total, lead us from partial suppression or extreme scantiness of urine to the circumstances in which suppression is complete or the secretion totally absent.

Suppression after surgical operations.

As a corollary to the suppression of the disseminated suppuration of local origin may be placed the fact that occasionally after catheterisation and operations upon the urethra, the urine has become suppressed and the kidneys have been found intensely congested. It is probable that this condition is but the early stage of the suppurative process, which has been sufficiently dwelt upon. Nephrectomy, ovariotomy, and other operations involving the abdominal and pelvic organs, have been followed by suppression apparently of a different kind. Mr. Godlee[1] removed by abdominal section a kidney which was the subject of calculous pyelitis (page 993). The patient survived the operation for twenty-four hours, for the last twelve of which only an ounce and a half of urine was secreted. The preceding urine was black with carbolic acid absorbed during the operation. The remaining kidney presented a normal appearance to the naked eye, and practically so to the microscope. Mr. Howard Marsh[1] (page 995) removed in part, through the loin, a sacculated kidney. Complete suppression of urine followed the operation, and death at the end of thirty hours. The remaining kidney was 'fairly healthy.' The capsule was adherent, and there were two or three small cysts on the surface, but there was nothing to indicate advanced disease. Much temporary diminution of urine has been known to follow ovariotomy, as in a case recorded by Mr. Thornton.[2] How the suppression is produced in the circumstances which have been adverted to is not very clear. It is not from any visible change in the kidney itself. It must be taken into question whether it is to be hypothetically attributed to an inhibiting nervous influence, or, what is more consistent with other experience, to the collapse produced by the operation, or the general failure of function which may precede death.

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[1] *Clin. Trans.*, vol. xv., p. 134.

Obstructive suppression

The most striking cases are those which have been described as *obstructive*, the suppression being due to a substantial barrier between the mammillary processes and the bladder.

Putting aside the rare occurrence of arterial obstruction, and the obvious systemic causes of suppression—collapse, intestinal stoppage, cholera, and poison—it is at least of exceeding infrequency to find the secretion of urine arrested for forty-eight hours, and that totally, except there be a palpable obstacle. And where this exists it is due in nine cases out of ten to stone. For a detailed account of the occurrence under these circumstances I must refer to page 951. It is only needful here to recapitulate the general character of the affection and to describe the causes, unconnected with stone, to which it may be due.

By stone.

When mechanical obstruction produces suppression, either both kidneys are simultaneously obstructed, or else, what more often happens, the obstructed kidney is the only source of urine, the other having been incapacitated by previous disease.

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[1] *Ibid.* p. 140.

[2] *Ibid.* p. 144.

Calculi, for example, may be symmetrically disposed in the two kidneys; or, on the other hand, one kidney having been sacculated or atrophied by a past fit of stone, the ureter belonging to the other may become occluded by a similar impediment and a total stoppage ensue. Examples of both these occurrences have been related.

Hydronephrosis.

Suppression of urine may be due to simultaneous sacculation of both kidneys—double hydronephrosis, as it is called—whether due to calculi or to congenital or other obstruction; and it may be produced by morbid growths, which are so circumstanced as to press at the same time upon both ureters. A case of double hydronephrosis has been quoted in which suppression, for the most part incomplete, was succeeded by copious discharges of urine and coincident diminution of an elastic lumbar swelling. Renal tumefaction lessening suddenly with increase of urine may be regarded as characteristic of the affection. The bowels in the same case were obstinately confined, in consequence, as was found, of compression of the descending colon by the cyst representing the left kidney. From the apposition of the colon and the kidney intestinal obstruction may often be suggestive of renal enlargement. These circumstances, together with other evidences of renal tumour, will suffice to distinguish hydronephrosis as a cause of suppression from the other conditions to which the arrest may be due. A further presumption of hydronephrosis in a case of suppression may be found in the recurrence of urinous sweating. Suppression of urine from obstruction, unaccompanied with dilatation of the kidney or vesical retention, does not give rise to this symptom, which, on the contrary, is sometimes strongly marked with hydronephrosis. Urinous exhalations from the skin are generally associated with the accumulation and resorption of urine. It is scarcely necessary to repeat that to produce suppression hydronephrosis must exist on both sides, or if it be confined to one, the ureter of the healthy kidney must be obstructed by some other means.

Growths.

Lastly, suppression may result from the consentaneous obstruction of both ureters by a morbid growth. Growths which produce this effect are usually cancerous, and arise in connection, not with the kidney or ureter, but with one or other of the pelvic viscera which occupies the median line. Tumours which originate in the kidney or ureter are usually confined to one side, leaving the gland on the other free to act. When both ducts are occluded the disease has commonly arisen external to and between them in connection either with the bladder or prostate, or with the uterus or vagina. Growths in connection with these organs are apt to start nearly equidistant from the ureter, and, spreading to the right and left, to involve both simultaneously or in succession. Less often both ureters have been known to have become occluded by growths which have begun in the ovary.

I may cite from the experience of Mr. Hutchinson the following instance in which cancer of the vagina and bladder produced total suppression for eleven days.

Case of suppression from cancer of vagina and bladder.

A woman,[1] 60 years of age, came into the London Hospital for suppression of urine, under Mr. Hutchinson. A week before the suppression commenced she had had a fall, after which a little blood passed with the urine; but excepting this nothing very particular had occurred until, five days before her application, she ceased to pass urine. She asserted that during these five days she had literally passed none. A catheter was introduced, but only a drachm or two of bloody fluid escaped. She looked pale and ill, and stated that she had been ailing ever since the preceding January.

An examination per vaginam disclosed the existence of extensive carcinomatous ulceration of the anterior wall of the vagina and neck of the uterus; the parts were closely united to the bladder. This discovery led to the suggestion that the ureters were possibly occluded in their passage through the walls of the bladder, and that the fall had probably no real connection with the symptoms.

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[1] Taken, with a slight abridgment, from the *Lancet*, June 3, 1871, p. 744.

The patient lived for six days after her admission, without passing a drop of urine, making eleven days of total suppression. A drachm or two of blood and mucus came away whenever the catheter was used. The most prominent symptom was constant and distressing sickness, urea being contained in the vomited matters. The pulse, seldom more than 80, ranged from 66 to 112. The temperature gradually rose from 98·4 to 100. The tongue towards the last became dry and the abdomen tympanitic. She had much thirst, and pain in the back and abdomen. To the last day of her life she was conscious, though she occasionally complained of feeling light-headed, and on the day of her death had an attack of convulsions.

The fundus of the bladder and adjacent part of the vagina were involved in a mass of cancerous induration; both ureters passed through it and were obstructed. Above, the ureters were dilated to the size of the small intestine. The pelves were dilated and contained a little grumous fluid. The kidneys were large, flabby, congested, and soft.

From disease of bladder.

Suppression of urine may be produced by disease of the bladder itself. A woman died in the obstetrical ward at St. George's Hospital after suppression of urine which was complete, as far as was known, for ten days, excepting that on the sixth day she fancied she passed a little in a bath. It was found that the bladder was the seat of extensive encephaloid growth by which the orifices of both ureters were obstructed. The growth was primary to the bladder.

General considerations regarding obstructive suppression.

In cases of suppression from growths the symptoms of the primary disease are usually obvious. Growths cause suppression far less often than calculi. The symptoms of obstructive suppression, putting aside those which are due to the special cause, are much the same whatever be the nature of the obstruction. They have been described in connection with calculi. The urine, if any be passed—and generally some is passed at irregular intervals—is pale, watery, of low specific gravity, and wanting in urea.

The watery character of the urine under these circumstances, with its low specific gravity and want of colour, are, as has been shown by Dr. Roberts,[1] important indications that the secretion has taken place against adverse pressure. In the normal dynamic state of the renal apparatus pressure exists within the blood vessels, but none in the tubes. This difference of pressure upon the two sides of the membrane between the blood and the urine is, as has been shown by experiment, a condition essential to secretion. It has been shown in animals that when the renal artery is narrowed by means of a clamp, so as to lessen the blood pressure in the kidney, the urine is diminished; while conversely a similar result follows when the urine is made to exert pressure backwards. A column of mercury in the ureter causes the urine to be produced in diminished quantity, and with a diminished percentage of urea, the secretion becoming poorer and more scanty with each increase of pressure, and at last stopping altogether. Corresponding changes take place when the ureter is obstructed in the human being. The distension of the pelvis at first retards and then arrests the secretion. Any small quantities of urine which the obstacle permits to escape during the process, having been secreted against pressure, are pale, watery, and deficient in urinary elements. The urine under the circumstances is sometimes, but not necessarily, albuminous. This depends upon the previous state of the kidney, and on the amount of congestion which the arrest of secretion has engendered. There is a total absence of dropsy, and unless urine be retained in a dilated kidney or elsewhere, there are no urinous exhalations from the skin or lungs. There is a progressive failure of strength, succeeded almost always by twitching of the voluntary muscles. The respiration becomes embarrassed and the action of the heart enfeebled. The digestive system is disturbed, as evinced by vomiting, loss of appetite, coating and subsequent dryness of the tongue. Sometimes thirst is complained of. The mind usually remains clear, or but slightly affected. Occasionally drowsiness, or want of sleep, or distressing restlessness supervenes. The pupils, towards the end, become contracted. Sometimes, but by no means constantly, epileptiform convulsion takes place, and more rarely death is preceded by coma. More frequently death takes place in a somewhat sudden manner, apparently from asthenia.

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[1] 'Paper on Obstructive Suppression of Urine,' *Manchester Med. & Surg. Reports*, vol. i., p. 232.

Obstructive suppression affects the heat of the body slightly, but with some constancy. In five cases of which I have particulars before me, the highest recorded temperature was 100·0, the lowest 97·0. It is not unusual for there to be a slight febrile disturbance at the outset, indicated by the higher temperature: but as the condition continues the temperature usually becomes subnormal, as is the rule with uræmia, whatever its cause may be. Mr. Hutchinson's case of obstruction by cancer, (page 1301) appears to be peculiar, insomuch that the temperature rose, instead of falling, as the results of suppression declared themselves.

The duration of cases ending fatally is very variable. Where the urine has, before the stoppage, escaped with difficulty and consequent impoverishment, death may occur after a few days only of total arrest. Dr. Roberts fixes the ordinary duration of complete obstructive suppression at from nine to eleven days. Cases are elsewhere related (page 951) in one of which total suppression lasted for twelve days, and in another suppression, total but for one interruption, lasted for twenty-two days. This last case, however, is very exceptional in its duration. In the great majority obstructive suppression proves fatal in the course of the second week. The passage of small quantities of such urine as has been described gives but little protraction.

The following case is of interest as probably combining two of the conditions which have been considered :—

Case of suppression probably obstructive together with nephritis.

A boy, 10 years old, whom I saw with Dr. Butler, had on several occasions passed blood with the urine. It was said that he had done so shortly after birth, in sequence to an attack of measles. At the age of five years he had a profuse recurrence of hæmaturia, and later several slighter ones. The attacks were always unattended with pain, or with any other obvious sign of illness. He had never had dropsy, nor had there been rigors or recurrences of fever such as to suggest intermittent hæmaturia, nor had he passed calculi, or, so far as was known, gravel. A brother of the patient had, however, once passed a stone after temporary suppression of urine; and two of his sisters were the subjects of hæmaturia at the time that his case was under consideration.

The urine became bloody for the last time on December 17, 1880. As at other times, there had been no other symptom to attract attention, nor could any immediate cause be ascribed. It was supposed that he had caught cold, but this was indefinite. There had been an attack of vomiting, but this was attributed, apparently with reason, to a heavy dinner.

The hæmorrhage was profuse, and lasted several days. Dr. Butler saw on the 20th several vessels of urine, passed at different times, all deeply coloured with blood, and containing small shreddy coagula. The body heat was then 99·7. The urine became somewhat less bloody, but remained abundant up to the midnight concluding the 22nd. At about this hour some bloody urine was passed, and afterwards only the minute amounts about to be mentioned. There was no other fresh symptom nor anything to be noticed, except that the habitual need to empty the bladder no longer presented itself.

I first saw the boy on the evening of the 24th. He had been a little sick, and brought up bile; but there was no œdema or drowsiness, or any very obvious sign of illness. Some elastic fulness could be felt about the left lumbar region: there was now no pain or tenderness in the loins, but I was told that at the beginning of the illness there had been some pains in this position, and 'pricking' on pressure. The abdomen was flat and soft; about an inch on either side of the umbilicus, in the position of either kidney, a limited deep hardness, or swelling, could be felt, pressure upon which caused nausea. The pubic region was so hollow and resonant that the use of a catheter was deemed superfluous.

The scrotum was tight and the penis erect, as it had been for some days past. The skin was cool, the pulse quiet, and the patient without discomfort. A digitalis poultice was now ordered to the abdomen (one had been already applied to the loins), together with a drachm of the infusion internally every three hours. On the morning of the 25th the condition was much the same; the boy bright and cheerful, the pulse weak, and not quite regular; temperature in the axilla 97·7. About a quarter of a drachm of dark brown turbid fluid, like the dregs of beef tea, was given to me as having been passed that morning by the urethra. I found it to be intensely albuminous and to swarm with large casts, many of which were coarsely granular and tinted with blood, others hyaline and colourless, but strongly marked. There was also a large deposit of renal epithelium, pus, and blood corpuscles, and some pear-shaped and tailed cells, evidently from a mucous surface.

On the evening of the 25th, at eight o'clock, he rather suddenly became faint, and died—he had been talking cheerfully a few minutes before. He had no convulsion, nor was any twitching observed. The only discomfort he had was retching and sickness, a little green bile being vomited more than once on every day after the suppression set in. The bowels had been kept loose.

The several small amounts of urine which were passed may be conveniently stated together. Bloody urine was passed freely at midnight, concluding the 22nd. On the morning of the 23rd about a teaspoonful was passed, and a little was thought to have escaped during the day with an action of the bowels. On the morning of the 24th two teaspoonfuls were passed; on the morning of the 25th a quarter of a drachm was passed, the only urine which I had an opportunity of examining. On the evening of the 24th, shortly before death, a teaspoonful was passed of urine which had a similar appearance to that described. Thus during a period of sixty-eight hours the quantity of urine passed, putting aside some thought to have escaped during a movement of the bowels, was about half an ounce.

As all endeavours to obtain a post-mortem in this case were unsuccessful, it is only possible to balance the considerations which should point to its nature. This much is declared for certain by the few drops of urine which were obtained—there existed congestive nephritis. Nephritis may be fatal before dropsy appears; it may have been so here. Suppression so nearly total is rare as a consequence of nephritis, but something approaching it is not unknown. But it is clear that the whole story cannot be explained by nephritis. The bleedings from the kidney, repeated for years without lasting or increasing deterioration of health, could scarcely have occurred but for stone; and this view is corroborated by the family history, in which calculus has its chapter. If stone existed then, was the suppression obstructive, and not albuminuric? The course of the disease and the mode of death suit well with obstruction. Against the view of at least *simple* obstruction, the urine was not the pale issue of a healthy kidney with impeded outlet, but was loaded with the products of renal inflammation. It is to be inferred that both causes concurred in this case. There probably existed symmetrical obstruction of both kidneys, or obstruction of one with obliteration of the other; and we must suppose that behind the dam nephritic congestion set in. The usual state of the urine under mechanical obstruction shows this to be exceptional; but yet it is not unknown for considerable congestion to occur in these circumstances. In Sir James Paget's case, already referred to (page 966), the kidney, of which the ureter was stopped by a stone, was found to be 'hypertrophied and gorged with blood.'

I have dwelt but little upon treatment, as it proved unavailing. It was designed mainly upon the view of mechanical obstruction. Warm hip-baths, digitalis and other diuretics, and change of posture were resorted to in the hope that they might assist the passage or shift the place of a calculous impediment.

Suppression from arterial obstruction.

The rare occurrence of suppression of urine in connection with obstruction of the abdominal aorta or both renal arteries completes the enumeration of the circumstances especial to the kidney under which the secretion of urine may be arrested.

A case is related by the late Dr. Todd in which suppression, nearly complete for five days, accompanied the formation of a dissecting aneurism which involved the aorta and probably the renal arteries.[1]

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[1] *Med. Chir. Trans.*, vol. xxvii.

A gentleman 37 years of age, while sitting at dinner, apparently in perfect health, was seized with an attack of faintness, which was subsequently found to depend upon an outburst of blood between the coats of the aorta. He had severe pain at first in the back and abdomen; next day in the loins, testicles, and groins. At this date the urine was scanty and high-coloured. A period of five days then elapsed, during which only a tablespoonful of urine was passed; there was no distension of the bladder, which, on the introduction of a catheter, proved to be empty. After this the secretion was gradually re-established. The urine first passed was in small quantity, acid, of low specific gravity (1009), distinctly albuminous, containing but slight traces of urea, and having a violet odour from the administration of turpentine. The patient gradually sank, and died on the eleventh day after the attack. The general symptoms were such as are usually observed in cases of dissecting aneurism of the aorta. The nervous system was involved, as was shown by drowsiness, torpor, and partial paralysis of the face and all the limbs. Death was preceded by a slight convulsion. A systolic murmur was heard which extended along the course of the innominate artery.

On post-mortem examination the appearances were typical of dissecting aneurism. The primary rupture was a transverse rent, involving the inner and middle coats of the aorta, half an inch from the semilunar valves, in connection with an ulcerated patch of atheroma. Blood had thence made its way by splitting the middle coat of the vessel, and had thus traversed the thoracic aorta and the large branches proceeding to the head and upper extremities. The abdominal aorta was, by an unfortunate oversight, not examined, but the symptoms leave no doubt that it was involved in the same change. The kidneys were 'very large, much congested, and in the second stage of granular disease.' The state of the renal arteries is not mentioned.

The pericardium was full of recent coagulum, blood having reached this cavity by a small rent in the outer coat of the vessel. The pericardial hæmorrhage was probably the immediate cause of death. The right side of the brain, the vessels leading to which were more obstructed by the injury than on the other side, was anæmic, and in some parts softened.

The suppression probably occurred upon the occlusion of the renal arteries by the extension of the rupture, and was removed upon re-establishment of the circulation. It is interesting to observe that the urine first passed was pale and of low specific gravity, probably in consequence of the deficient blood-pressure under which it was produced. Similar urine is produced when the blood-pressure within the kidney is neutralised by counter-pressure of urine in the pelvis.

Some interesting illustrations of the effect of obstruction of the aorta upon the urine are given by Dr. Bristowe.[1] In two instances, in which the abdominal aorta was suddenly obstructed by coagulum belonging to aneurisms of this vessel, the urine was at first suppressed, then scanty, bloody, and highly albuminous. In one of these cases no urine was passed for twenty-four hours after the presumed date of the obstruction, and then only three ounces, which were albuminous to two-thirds, and contained casts and blood. The return of the secretion after its stoppage is probably due to the re-establishment of the circulation by the collateral channels which connect the upper and lower parts of the aorta. The kidneys were found in each case to be greatly congested, correspondingly with the evidences of nephritis which had been evinced during life. The hyperæmia, or inflammation, might have been partly explained in one instance by the presence of blocks, or infarcts, derived from the detached clot, which may have been sources of irritation; but in the other case no such explanation was presented. It is to be observed that other structures in the territory of the obstructed vessels—the bladder and rectum for example—were likewise congested and ecchymosed. Thus congestion of some sort, probably venous and by reflux, may be a late result of arterial stoppage. The congestion about fibrinous blocks is well known; and it is at least of interest to associate with these phenomena the nephritis which succeeds upon the suppression of collapse.

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[1] Three cases of sudden obstruction of the abdominal aorta by aneurism, *Lancet*, 1881, vol. i., p. 131-166.

SYSTEMIC SUPPRESSION OF URINE.

Suspension of the renal function may occur in connection with cerebral injury or concussion, or with a variety of other morbid conditions, of which it is to be noted that they are generally accompanied either by universal collapse or by unwonted discharges of fluid from some other exit, or by both these conditions conjointly.

From concussion of brain.

Concussion of the brain may be a cause of transient but total suppression. The suspension of nervous function, though chiefly relating to voluntary movements, is not confined to them, as is seen by the embarrassment of respiration sometimes present. The kidney, with its pneumogastric communications, is especially under the control of the brain, and its action is increased, altered, or suspended by cerebral causes. Suppression from concussion is necessarily transient, terminated shortly either by recovery or death.

Case of suppression after a fall.

The following case was related to me by Dr. MacLaurin, late of the Royal Navy, in whose ship it happened. A seaman, 20 years of age, fell into the hold, a distance of 20 feet. When taken up he was apparently suffering from concussion of the brain. There was no evidence of external injury, nor was he collapsed. He remained perfectly insensible, with slow pulse and dilated pupils. He could not speak or swallow. According to custom in such cases, a catheter was passed to ascertain whether there was any laceration of the urinary organs. The bladder was penetrated without difficulty, but no urine could be obtained. The accident occurred at three o'clock in the afternoon. The next morning, the condition of the patient being the same, the operation was repeated with the same negative result. The head was shaved, cold applied, and a purgative enema administered with the consequent removal of a quantity of fæces. At 8 P.M., twenty-nine hours after the fall, two ounces of urine were obtained with the catheter. The secretion was natural in appearance, and free from albumen. From this time he began to recover consciousness and the power of swallowing fluids, and after the lapse of forty-eight hours from the accident the urine began to be produced naturally, and so continued. He ultimately recovered.

Collapse as a cause of suppression.

There are general states of system expressed by the terms prostration, collapse, and exhaustion, in which for a time the urine ceases to be formed. The renal is suspended in common with other functions, and is restored with them should reaction occur.

The suspension is, in its nature, temporary, the secretion returning as the strength of the circulation is restored and the exhausted vessels are replenished. In some of the conditions in which the urine is thus absent, cholera and some forms of poisoning, at least two causes may be supposed to concur—failure of circulating force, with loss of circulating material. But we may consider first a simple relationship which exists, quite independently of depletion or change of blood, between unmixed collapse and suspension of renal action. Suppression from this cause has been frequently observed in connection with perforations of the stomach, of the duodenum, of the jejunum, of the ileum, from typhoid fever or otherwise, and in connection with penetration of the large intestine. It has been known to follow laceration of the bile ducts. Under such circumstances death usually comes too rapidly to allow of any very protracted suppression, but it has been noted that as long a time as two days has passed without any secretion. After death it is usually found in these cases that the bladder is empty and contracted; and it would seem that not mere emptiness, but unnatural contraction of that organ, has in some instances existed during life, as painful straining, a fallacious sense of distension, and a resistance to the catheter thought to be unusual, have been observed.

The immediate cause of the symptoms in these cases is probably an influence upon the abdominal centres of the sympathetic through irritation of the peritoneum by the extruded matter. And it is known that other causes of collapse, acting possibly on other nervous territories, but equally unconnected with any material drain, may also be accompanied by suppression of urine.

In collapse, upon whatever it may depend, there appears to be a general contraction of the arterial system, the blood being driven thence to stagnate in the veins. The left ventricle is, as seen after death, contracted to the utmost, the arterial pulse everywhere fails, becoming feeble in the large arteries, and imperceptible in the smaller, while the skin is cold and cadaverous, giving in warmth and colour no evidence of moving blood. The condition would seem to be one of hindrance in the vessels rather than failure at the heart—arterial closure, not cardiac weakness. The contracted and empty left ventricle, unlike the relaxed and loaded cavity of asthenia, has done its duty. But the blood, probably from a kind of spasm affecting alike heart and arteries, does not circulate, the absence of circulation being, under these circumstances, more complete than with asthenia, is long compatible with life. With the absence of circulation the derivatives of blood necessarily cease to be formed, and urine, like other secretions, is in abeyance.

Poisons.

Suppression of urine may be produced by certain poisons, especially when their action is attended with collapse. Corrosive sublimate has, more often than any other poison, been followed by this symptom, though the same result has been known to arise from the mineral acids, putrid animal matter, poisonous fungi, and occasionally from arsenic.

With regard to corrosive sublimate, a poisonous dose of this substance produces a condition of collapse which resembles, as Mr. Sedgewick has shown,[1] that of cholera; the intestinal discharges are usually but not always excessive, and the urine, often for several days, totally wanting.

A case was reported by Mr. Syme in which a man under the influence of a mercurial salt, administered externally, had total suppression for five days, the catheter being repeatedly introduced, with the removal of two or three teaspoonfuls of mucous-looking fluid 'destitute of urinous smell.' The patient drank freely during the suppression; he remained sensible and eventually recovered.[1]

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[1] Much information regarding toxic suppression of urine is given by Mr. Sedgewick in a valuable paper on some analogies of cholera. *Med. Chir. Trans.*, vol. li., p. 1.

Taylor[2] relates the case of one John Wright, 38 years of age, who swallowed two drachms of corrosive sublimate, and an hour afterwards was received into Guy's Hospital.

'There was great depression of the system; the limbs were quite cold; the respiration was natural; the pulse small, wiry, and scarcely perceptible; the tongue swollen, as well as the lips. The man was sensible, and complained of constriction of the throat. Albumen was immediately administered to him. In three hours after his admission the lips were swollen and tender, as well as the gums; there was incipient salivation, with pain extending down the gullet into the stomach. The act of swallowing gave rise to much pain. The man had vomited several times, and brought up a quantity of yellow matter, interspersed with blood; he complained of slight pain in the abdomen. There were spasms of the lower limbs: the knees were drawn up; the pulse was small and scarcely perceptible; the tongue was white, and so much swollen that he could not protrude it from his mouth. These symptoms continued more or less during the four days which he survived. There was complete suppression of urine, with occasional discharges of mucus mixed with blood from the bowels. Before death there was delirium; the man died in a comatose state.' On post-mortem examination, there were found evidences of the congestion and inflammation of the alimentary canal, usual in such cases. 'The kidneys were of a natural size and consistence, rather florid. The cortical portions presented minute red points, more especially between the infundibula, probably the results of commencing inflammation. The right kidney had a cyst on its posterior surface about the size of a marble, containing clear fluid. The bladder was much contracted; the mucous membrane slightly injected; it contained about half an ounce of turbid urine.'

It would be easy to collect many other instances of poisoning by corrosive sublimate in which there has for many days been a total cessation of the urinary secretion. Mr. Sedgewick, in the paper referred to, quotes the case of a boy who died five days and six hours after taking this poison, where the urinary secretion during the whole time was suspended, and the bladder after death contracted. He mentions also a servant girl, who died from the effects of corrosive sublimate on the eighth day, with whom there was total and permanent suppression; no urine could be obtained with the catheter, and after death the bladder was empty and contracted.

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[1] Mr. Sedgewick, *loc. cit.*

[2] *Guy's Hospital Reports*, 1844, p. 24; also Taylor on 'Poisons,' 2nd ed., p. 447.

In such cases it would appear that the suspension of secretion is due to the general state of collapse rather than to any change localised in the kidneys. Where the kidneys have been examined, they have been described either as natural, or, as in the case quoted on page 1313, as presenting only a slight degree of congestion, not enough to add perceptibly to their bulk or materially change their aspect. So slight a local change is totally insufficient to account for the arrest of function. We must, therefore, look for the cause of the cessation in the state of system rather than of kidney. Two systemic causes of suppression may concur in these cases: first, exhaustion by profuse discharges, with possible diversion of urinary fluid; secondly, the restraint of arterial flow which belongs to collapse. Of these it is probable that want of circulation has more to do with the absence of urine than have the diarrhœa and vomiting. The loss of fluid in these cases is not generally such as would seem to counterbalance the missing secretion, and it may be observed that with poisoning, more especially with nitric acid, where similar suppression follows, the bowels are obstinately confined. We may therefore presume that the suppression of corrosive sublimate is a part of the collapse which attends the action of this poison.

With poisoning by nitric acid suppression of urine is especially associated. Extreme collapse is present in these cases. There is vomiting, but no diarrhœa; on the contrary, the bowels are usually confined, and are found after death to be occupied by indurated fæces. Suppression has also been noticed in cases of poisoning by sulphuric and hydrochloric acids. With regard to arsenical poisoning, the urine is suppressed occasionally and for short periods, but not with any regularity.

Finally, suppression of urine has been noticed in connection with the choleraic symptoms produced by putrid meat and poisonous fungi. It is probable that in all these cases the suppression is due to the state of circulation which constitutes collapse. It is manifest that the profuse loss of fluid by diarrhœa and vomiting which occurs in some forms of poisoning and in cholera must also tend to diminish the urine. Suppression may therefore be especially looked for where profuse discharges have produced, or coexist with, a condition of collapse. Cholera and poisoning by corrosive sublimate are the typical examples of this morbid concurrence.

Choleraic suppression.

The suppression of cholera is complicated, partly systemic and partly renal, arising from general, but frequently protracted by local, causes. In the cold stage there is, as a result of the intestinal drain, the general condition of arterial emptiness, the loss being especially of the water of the blood, which is essential to the solution and elimination of the urinary elements. The rice-water evacuations of cholera[1] are chiefly aqueous, insomuch that on an average 100 parts of rice-water stool contain more than 98 of water, the small amount of solid matter consisting chiefly of salts of potash and soda, with only a trace of albumen. They contain no urea, and of uric acid have given but rare and doubtful indications. They take the water, but leave the renal excrementa. The blood accordingly becomes viscid; its specific gravity is greatly increased; its water is lessened; the organic solids are proportionally raised, after much purging, even to half as much again as in health, and urea is constantly found. This condition of dehydration, together with the failure of circulation which accompanies it, produces a general suspension of all the fluid secretions which are not under the stimulus of the disease. Urine may accordingly be absent during collapse for thirty hours, or even longer. But, though unable to respond by secretion, the kidneys, even at this stage, give evidence of irritation, which we must ascribe rather to the urinary elements in the blood than to any direct influence of the cholera poison. The kidneys, if examined during or immediately after the stage of collapse, though not as yet much altered in bulk, are congested sometimes to a general violet tint, some excess and some alteration of epithelium is found in the tubes of the cortex, while those of the cones frequently contain crystals of uric acid or oxalate of lime. With these signs of incipient inflammation the urine as it begins to reappear is scanty, albuminous, sometimes bloody, and loaded with casts, usually of the epithelial type. The kidneys may now gradually right themselves, or it may happen that the symptoms and local changes of acute tubal nephritis may develop. Early and marked uræmia occurs—it appears, indeed, that what is termed the consecutive fever, or the typhoid stage of cholera, so far resembles uræmia in its symptoms that we cannot but regard this condition of blood as one of its pathological factors. The[1] kidneys under these circumstances are found to be in a condition of tubal nephritis, they are much increased in bulk, weighing, as in a case mentioned by Dr. Gull, 15½ ounces; they are pale, loaded with more or less fatty epithelium, and are, in short, in a typical condition of tubal inflammation, not unlike that which results from exposure to cold. The urine is scanty, albuminous and deficient in urea, and occasionally dropsy ensues. We thus have in cholera a condition of complete suppression arising in dehydration and collapse, and succeeded by partial suppression depending upon renal inflammation.

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[1] On the intestinal discharges in cholera, Dr. Parkes, *Lond. Jour. of Med.*, 1849, p. 134.

Reports on epidemic cholera, published by the College of Physicians, *Path. Report*, by Dr. Gull, p. 44.

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[1] Report on epidemic cholera, published by the College of Physicians, *Path. Report*, by Dr. Gull, p. 137.

From ague.

A cause of transient suppression, connected presumably with renal congestion, may be occasionally found in the so-called cold stage of ague, under which influence the urine has been known to be absent for a time, to reappear albuminous or bloody. We may attribute the accident to the driving inwards of the blood upon the kidneys as upon other internal organs.

From intestinal obstruction.

In cases of intestinal obstruction the urine is often much diminished, and sometimes entirely withheld. The following case is related by the late Dr. Barlow[1] :—

Case of suppression from obstruction of jejunum.

A boy, 12 years of age, who had already had several attacks of crampy pain in the belly, sickness, and constipation, was seized on March 24 with severe pain across the bottom of the belly, followed by vomiting. He was brought to Guy's Hospital on the 30th, having, for the six days succeeding the attack, had no evacuation either of stool or urine, except a very trifling one on the 26th. When in the hospital, he lay on his side, but was exceedingly restless. The surface was cold and pallid, and the skin harsh and dry; the face congested, and having a bluish tinge; expression anxious; eyes sunken and heavy; cheek-bones prominent; the whole aspect betokening serious mischief as well as great prostration. There was great tendency to stupor, but his intellect was clear; voice feeble; tongue clean, but dry. The first sound of the heart was almost lost in the second. The belly was not much distended, nor very tender. No urine had been passed for five days. On the 31st, the urine still being absent, a catheter was passed, and one ounce of urine, pale, straw-coloured, and free from albumen, was obtained. On the following morning, April 1st, an ounce and a half of urine, which was slightly clouded by heat, was drawn off. His general symptoms underwent no material change excepting that he was influenced by opium until his death, on the 1st of April.

It was found that the cause of the obstruction was a band of false membrane connecting the duodenum with one of the upper coils of the jejunum, and compressing the bowel in the latter situation. The intestine was full of fluid fæces. The peritoneum was somewhat red, and upon it were scanty fibrinous deposits; but there was no acute peritonitis, nor had there been any extravasation of the contents of the bowel. The kidneys were full and soft.

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[1] *Guy's Hospital Reports*, 1844, p. 378.

This case furnishes an extreme example of suppression as the result of obstruction of the bowels, five days having elapsed without any discharge and two more with only two and a half ounces.

It has been generally stated that the amount of urine formed with intestinal stoppage is a guide to the position of the obstacle—the higher the obstacle the less the urine—the diminution of the secretion depending, as was thought, upon the loss of the absorbing surface below the stricture. But, as Dr. Brinton has shown, this relationship is by no means invariable, copious urine sometimes concurring with a high obstruction, and scanty or temporarily-suppressed urine with a low one. Beside the mere loss of absorbing surface, there are at least two other morbid conditions to consider in connection with the renal secretion under these circumstances; first, the drain of fluid by vomiting, which, especially when the obstruction is near the stomach, is profuse and apparently out of proportion to what has been swallowed; and secondly, the collapse, so often productive, as has been shown, of anuria, but which has relation to the nature of the lesion rather than to its position.

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